

N.V.S. Sarathy
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SYMPOSIUM ON HARVEST AND POST-HARVEST TECHNOLOGY OF FISH

24-27 November, 1982

COCHIN - INDIA

ABSTRACTS OF PAPERS



Society of Fisheries Technologists (India)
Matsyapuri P. O., Cochin-682 029

Symposium on Harvest and Post-Harvest Technology of Fish

24-27 NOVEMBER, 1982

Cochin - India

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Symposium on Harvest and Post-Harvest Technology of Fish

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Technical Sessions

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TECHNICAL SESSIONS

Session I RESOURCES

Date : 24-11-1982
Time : 14.00-17.00
Venue : CIFT Hall No. 1

Chairman : **Dr. E. G. Silas**
Director, Central Marine,
Fisheries Research Institute,
Cochin-682 016

Keynote Address : **Dr. N. Balakrishnan Nair**
Professor & Head,
Department of Aquatic
Biology & Fisheries,
University of Kerala,
Trivandrum-695 007

1. TUNA RESOURCES OF THE INDIAN SEAS—AN OVERVIEW

E. G. SILAS & P. P. PILLAI

Central Marine Fisheries Research Institute, Cochin-682 018

As a part of the national policy for the judicious exploitation of the living resources of the Exclusive Economic Zone (EEZ) of India greater emphasis is to be given for the development of tuna fisheries, both in the artisanal sector and high seas. Tuna is one of the least exploited resources of the Indian seas, accounting for hardly 1.62% of the total marine fish catch in India at the 1980 level although there has been an appreciable increase in the landings of coastal species of tunas during the last fifteen years. At present, the fishery is mostly supported by coastal species such as *Euthynnus affinis*, *Auxis thazard*, *A. rochei*, *Sarda orientalis* and *Thunnus tonggol*. The shipjack tuna *Katsuwonus pelamis* supports a surface fishery in the Lakshadweep, and in 1980 about 1760 tonnes of this species was landed there in the pole and line (live-bait) fishery. Availability of live-baits has been instrumental for the fluctuation in tuna catch in this area. A detailed analysis of the zone-wise landings of tunas along the Indian coast and in the Lakshadweep sea is presented for the period 1965–1980, indicating the changing pattern and trend of the fishery. Information on the exploitation of the major tuna resources of the EEZ of India by the longliners of Japan, Taiwan and Republic of Korea during the late 1970's is also presented. In order to comprehend the pattern of production of tunas and billfishes by the Non-Indian Ocean countries (longline operation), Indian Ocean rim countries and oceanic islands in the Indian Ocean area, an analysis of the quantum of exploitation of these fishes during the period 1977–1980 has been made and the results presented. Possible management measures for the development of tuna fisheries by India are also suggested and discussed.

2. SOME OBSERVATIONS ON THE RESOURCES OF THE INDIAN MACKEREL (*RASTRELLIGER KANAGURTA*) (CUVIER)

A. NOBLE

Mangalore Research Centre of Central Marine Fisheries Research Institute, Mangalore

The Indian mackerel is an important pelagic fish resource of our country. Annually on an average about 75,000 tonnes of mackerel were landed during 1950-80 period, and it formed only less than 10% of the country's marine fish catches. Annual landings showed wide fluctuations from year to year, at the same exhibiting a ten year cycle with ups and downs in the trend, ups appearing in and/or around the confluence of 2 decades and the downs wedged in the mid of one. From the lean landings of 1975 the catches that followed were going up and resulted in a hump with 85,233 tonnes in 1978.

The potential yield of mackerel estimated through the acoustic and aerial surveys and through investigations on populations is around 127,000 tonnes and the average yield in the seventies was 92,000 tonnes. As such there is not much fish stock left in the sea for large scale development of the fishing industry on mackerel and introduction of further fishing pressure has to be scientific and judicious and with caution as to sustain the stock. This is necessary as the mechanised units appear to exploit the fish engaged in the propagation of the species.

3. PELAGIC FISHERY RESOURCES AND EXPLOITATION ALONG KARNATAKA COAST—AN ASSESSMENT

P. A. PANICKER

Central Institute of Fisheries Technology, Cochin-682 029

Introduction of commercial purse seining along Karnataka coast has increased the production of pelagic fishery by about 30%. However from the present trend it is felt that there is over exploitation which may lead to depletion of stock. The author has analysed the data of commercial purse seining from 1977 to 1981 using the method of Surplus Production Mode taking Catch-Per-Unit-Effort as an index of relative

abundance of fish. The standing stock, maximum sustainable yield, the optimum effort and the catch per unit effort are worked separately for sardines, mackerels and mixed species. The economic level of exploitation and effort for maximum sustainable yield are also discussed.

4. PRESENT STATUS OF THE MARINE FISHERY OFF OKHA AND DWARKA IN THE SAURASHTRA REGION OF GUJARAT STATE

M. R. BHANDARY, N. D. CHHAYA, N. G. AKOLKAR,
T. C. JADEJA & N. P. K. RAMAN

Gujarat Fisheries Aquatic Sciences Research Institute, Port Okha-361 350

Gujarat Fisheries Aquatic Sciences Research Institute has been conducting resource survey to identify the resource potential of various inshore and off-shore marine areas along the Gujarat coast and Okha, Dwarka and Jakhau fishing grounds were located. Since this discovery there has been manifold increase in fish production and related fishery activities in the area. The present study reports the developing trends due to increased pressure on the fishing grounds in relation to fishing efforts, species wise variations, catch rate, per unit productivity and change in economic returns.

5. DOL NET FISHERY OFF NAWABUNDER (GUJARAT)

MOHAMMAD ZAFAR KHAN

*Veraval Research Centre of Central Marine Fisheries Research
Institute, Veraval*

An estimated catch of 6,485, 3,506 and 4,798 tonnes of fishes was landed at Nawabunder in 'dol' net during 1976-77, 1977-78 and 1978-79 respectively. There has been an increasing trend towards effort and decline in catch and catch rate. The catch rate came down from 175 kg in 1976-77 to 84 kg in 1978-79.

Detailed studies on catch composition revealed that Bombay duck formed about 68.6-77.0% of the total catch. The other constituents

were *C. dussumieri* 1.5–9.2%, ribbon fish 3.0–6.5%, non-penaeid prawns namely, *A. indicus*, *Nematopalaimn tenuipes* and *Exhipposmata ensirostris* together formed about 6.1–13.7% and penaeid prawns 1.5–3.1% of the total 'dol' net landings. In addition, quality fishes such as 'Ghol', 'Wam' pomfret and cat fishes were also landed in considerable quantities. The landings of 'Ghol' is on the increase from 5 tonnes in 1976–77 to 59 tonnes in 1978–79.

Large number of juveniles of economically important fishes namely, *H. nehereus*, *P. argenteus*, *T. lepturus* and *I. filigera* have been observed in the catch particularly during February–May. The destructive nature of the gear has been commented along with suggestion for regulating the fishery.

6. COMMERCIAL TRAWL FISHERIES OFF VERAVAL DURING 1979-82

G. SUDHAKARA RAO, H. MOHAMAD KASIM & MOHAMMAD SAFAR KHAN
Research Centre of Central Marine Fisheries Research Institute, Veraval

Commercial trawling, started in 1967 on a moderate scale, has developed into a big industry by 1982. Analysis of the data on trawler landings during 1979–82 indicated the existence of rich rounds for demersal fisheries off Veraval. Estimated annual fish landings by trawlers varied from 22211 tonnes in 1980–81 to 31380 tonnes in 1981–82. The abundance of demersal species varied at random without indicating any seasonal trend. Important demersal fisheries were small scianids (13.7 to 27.8%), ribbon fishes (7.9 to 11.2%), prawns (6.2 to 9.7%) *Nemipterus* spp (7.3 to 7.9%), *Lactarius lactarius* (4.9 to 8.5%), cephalopods (3.7 to 6.4%), perches (3.7 to 5.5%) and clupeids (2.5 to 5.5%). Ghol (*Protonibea diacanthus*), Koth (*Otolithoides biauritus*), Wam (*Muraenesox talabanooides*), and Karkara (*Pomadysus hasta*), which formed major components of the catches of exploratory vessels during the years 1953–1970 formed only a negligible fraction of the commercial trawler landings. *Parapenaeopsis sylifera* formed the dominant component of the prawn landings forming about 20.4 to 30.8% of the annual prawn catches. Comparison with the trawler fisheries at Mangalore and Kakinada indicated the superiority of the trawler

fishery at Veraval. The fluctuations in catch per unit effort, total landings and species composition are studied. Although there is no threat of over fishing of the demersal fish resources in the near future it is suggested to keep a watch on the fishery in view of the rapid increase in the number of boats exploiting the resources. Importance of acquiring biological knowledge about the component species is stressed for better management of the demersal fishery resources.

7. PRAWN RESOURCES OF THE MAHARASHTRA COAST WITH SPECIAL REFERENCE TO PENAEIDS

S. RAMAMURTHY

*Bombay Research Centre of Central Marine Fisheries
Research Institute, Bombay*

Maharashtra with an annual catch of 66,150 tonnes contributes to 49% of the nation's marine prawn production. Non penaeid prawns constitute the bulk, the State's share being ninetenths of the All-India non-penaeid catch. Penaeids accounted for 30% of the prawn fishery of the State and 23% of the penaeid landing of India. Statistical analysis of the annual production of prawns in Maharashtra during 1961-80 revealed an upward trend in the case of penaeid prawns. For non-penaeids, the trend showed increase upto 1977 and thereafter gradual decline. The variations in the annual fishing effort have also been discussed. In view of the importance of penaeid prawns in the export market, the resource characteristics of this group at New Ferry Wharf, an important trawl landings centre at Bombay, were monitored during 1979-81 and the results relating to catch per unit effort, species composition, size and maturity of the commercial species have been presented in this paper.

8. CEPHALOPOD RESOURCES IN SOUTH WEST COAST OF INDIA

P. SULOCHANAN & M. E. JOHN

Cochin Base of Exploratory Fisheries Project, Cochin-682 005

The survey data collected by 17.5 m vessels based at Cochin Base of Exploratory Fisheries Project during the last three years (1979 to

1981) are analysed and the areawise, depthwise and seasonwise distribution of cephalopod resources is presented alongwith an estimate of potential yield. Altogether 6 major areas between lat. 08°N and 12°N were sampled for 3660 h and 4 tonnes cephalopod catch was recorded. Cephalopods, comprising of squids and cuttle fishes represented 10.9% of demersal catch. Two productive grounds were identified situated off Calicut and Quilon. The depth zone of 30–50 m yielded high catch rates. Monthwise availability study indicated bimodal distribution pattern, the peaks of availability being in March and November–December. The year 1981 yielded better catch rates compared to the previous years. Survey data collected by a 40.5m vessel from October 1981 to July 1982 in Wadge Bank and surrounding waters are also considered in the paper. 400 h trawling yielded 6 tons of squids and cuttle fish from the area. Demand in world markets for squid and cuttle fish products are increasing. The potential yield figure indicates further expansion of fishery for this export oriented marine resource.

9. THE FISHERY OF THE EDIBLE CRAB *SCYLLA SERRATA* (FORSKAL) (DECAPODA, BRACHYURA) IN THE COCHIN BACKWATER

K. V. DEVASIA & K. P. BALAKRISHNAN

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Cochin-682 016*

Cochin backwater is one of the highly productive estuarine systems situated along the west coast of India. It supports rich finfish and shellfish fishery. Among shellfishes the crab, *Scylla serrata* constitute an important fishery, occurring almost throughout the year. Commercial fishing for *S. serrata* commences with the onset of south-west monsoon and lasts till the end of north-east monsoon. During the active fishing season 4,000–5,000 crabs are brought to the processing industry. The crabs with a carapace width of 8 cm and above constitute the commercially exploited group. The distribution of *Scylla serrata* in the backwater is not uniform both in space and time. Certain areas of the estuary and certain periods are noted for its abundance. The paper also refers to the sex ratio, breeding period and craft and gear employed for the fishing of *Scylla serrata*.

10. CLAM FISHERY RESOURCES OF VELLAR ESTUARY

P. V. SREENIVASAN

Central Marine Fisheries Research Institute, Cochin-682 018

Observations made during January 1977 to June 1978 indicated the existence of rich clam beds in Vellar estuary. Clams were distributed from river mouth to 10 km towards the upper reaches of the estuary. Total stock varied in different months from 354 m. tons to 7050 m. tons of which 88 to 99% was formed by *Meretrix casta* and rest by *Katelysia opima*. Density of clams per square meter was observed to be always higher in the upper reaches (210 g to 5920 g), than in the middle (9.4 g to 2290 g) and lower reaches (1g to 864 g). *M. casta* was dominant in the former two areas while *K. opima* was more in the latter. Length composition of these clams in different months indicated that spat fall occurred during March-July period. Fishing was done by agricultural labourers by hand-picking and scooping with bamboo baskets during low tide. 1045 m. tonnes of clams was landed during the period of observation. 70% of this landings was utilised directly for lime industry and the rest for shucking meat. Further improvement to the fishery on scientific lines, proper utilisation of the harvested clams and augmentation of clam production by culture practices are some of the methods suggested for the development of clam resources of the Vellar estuary.

11. CRAB FISHERIES OF PULICAT LAKE WITH SPECIAL REFERENCE TO CATCHES FROM THE SOUTHERN SECTOR

S. SRINIVASAGAM & K. RAMAN

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Observations were made on the commercial portunid crab fishery of the southern sector of Lake Pulicat from April, 1968 to March 1972. The crabs (*Scylla serrata* and *Portunus pelagicus*) formed 10-12% of the total landings of fish, prawn and crab from the lake. The catches showed great year to year fluctuations. The major gears employed in the fishery, their mode of operation, the species and size composition are dealt with.

The estimated total annual crab catch from this area amounts to 38.8 tonnes. Of this, *S. serrata* accounts for 16.6 tonnes and the remaining is by *P. pelagicus*. Heavy montly crab landings were observed from January to May and July & August. Long line fishery accounts for the bulk (47.3 %) of the catches followed by stake nets (28.9 %), shore seines (21.7 %) and drag nets (2.2 %). A note on the crab marketing of this area is also given. The survey shows considerable scope for the development of crab resources by regular exploitation as well as by culture of the crabs in this area.

12. ESTIMATED RESOURCES OF DEMERSAL FISHERIES OFF NORTH TAMIL NADU—SOUTH ANDRA COAST BASED ON EXPLORATORY SURVEYS

E. VIVEKANANDAN & B. KRISHNAMOORTHI

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The results of analyses of exploratory trawling survey data for areas north of latitude zone $10^{\circ}40'N$ (off Velanganni) upto $15^{\circ}40'$ (off Nizamptanam) for a nine year period from 1973 to 1981 are presented. In the entire region explored, a potential yield of 1.1 tonnes/sq.km could be expected. Barring the latitude zone $10^{\circ}40'$, the lowest yield (0.7 t/sq.km) was observed off Madras/Ennore region ($13^{\circ}10'$). With this zone as a reference point the following conclusions could be drawn:(a)increasing trends in both southern and northern zones and(b) the northern zones were comparatively richer in yields.

Latitude-wise potential yields were estimated for certain major categories of demersal fishes and crustaceans. Silver bellies ranked first (0.4 t/sq.km). followed by perches (0.1 t/sq.km.). For prawns, the most productive zones were located off Ramayapatnam ($15^{\circ}10'$) in the north and off Porto Novo/Cuddalore ($11^{\circ}40'$) in the south.

13. MAN POWER AND FISHING EQUIPMENTS AVAILABLE AND THE EXPLOITED FISHERY RESOURCES IN THE COASTAL WATERS ON INDIA

T. JACOB, G. VENKATARAMAN, K. ALAGARAJA & S. K. DHARMA RAJA
Central Marine Fisheries Research Institute, Cochin-682 018

Information on the marine fishery resources is a pre-requisite for planning and development of harvest and post-harvest technology. In the country, there are about 2,500 marine fishing villages and 1500 landing centres. The total marine fishermen population is about 21.2 lakh of which 23% are active fishermen. There are about 19,000 mechanised fishing crafts of which 61% are trawlers, 21% gill netters, 15% dol netters and 2% purse seiners. The non-mechanised fishing crafts in the country work out to about 1.4 lakh of which the major constituents are plank-built boats (40,000), dug-out canoes (26,400) and catamarans (73,400). There are about 27,000 trawl nets and 450 purse-seines. In the non-mechanised category, there are about 3.80 lakh drift gill nets, 30,000 boat seines, 68,000 fixed bag nets, 67,000 hooks and lines, 19,000 shore-seines and 400 rampans. The total marine fish production in India varied from 1.26 to 1.40 million tonnes during the five year period 1977-81, the average catch being 1.34 million tonnes. A critical study on the statewise and species-wise landings and their trends during the last five years was made and an account of the same is presented.

14. FISH AND FISHERIES RESOURCES OF VEMBANAD LAKE WITH SPECIAL REFERENCE TO THEIR OCCURRENCE, SEASON AND FREQUENCY IN THE LAKE

B. MADHUSOODANA KURUP
Department of Marine Science, University of Cochin-682 016

C. T. SAMUEL
*Department of Industrial Fisheries, University of Cochin,
Cochin-682 016*

150 species of fishes belonging to 100 genera under 56 families were recorded from the Vembanad lake. The occurrence, season and fre-

quency of all the recorded fish species from the lake are given. Based on the occurrence the total recorded fishes were classified as residents, migrants and vagrants. The frequency of individual species in the lake is given mainly based on their relative abundance in the catches in the given season or months. Of the 150 species encountered from the lake, 49 species can be characterized as 'residents' which are perennially present in any of the sectors of the lake and most of them contribute to the stock of permanent lacustrine fishery resources, 73 species are 'marine migrants' which undertake regular migration into the lake from the inshore areas of the sea during pre and post-monsoon periods, 9 species have migrations from the adjoining rivers and 19 species are 'vagrants' which are entering the lake only accidentally either from sea or from the rivers. 42 fish species of the lake were found to be commercially important. The distribution and abundance of the fish fauna of the lake is correlated with the three important physico-chemical factors namely, temperature, salinity and dissolved oxygen.

15. GAMMARID AMPHIPODS OF COCHIN BACKWATERS

K. K. C. NAIR, T. C. GOPALAKRISHNAN, P. VENUGOPAL
GEORGE PETER & T. S. S. RAO

National Institute of Oceanography Regional Centre, Cochin-682 018

Systematics, distribution and numerical abundance of gammarid amphipods of the Cochin backwaters are discussed for the first time based on year round collections. This is one of the most dominant benthic faunas which has a deciding role in the benthic ecosystem and forms a rich diet for many of the commercially important prawns. Eleven species namely, *Corophium triaenonyx* Stebbing, *Grandidierell bonnieri* Stebbing, *G. gilesi* Chilton, *Cheiraphotis megacheles* Walker, *Photis digitata* Barnard, *Ampelisca zamboangae* Stebbing, *A. cyclops* Walker, *Periocolodes longimanus* (Bate and Westwood), *Eriopisa chilkensis* (Chilton), *Quadrivisio bengalensis* Stebbing and *Melita zeylanica* Stebbing, belonging to 9 genera are encountered. The highest population density (701,041/m²) is found in December and peak juvenile recruitment irrespective of species (107,391/m²) in September. *Corophium triaenonyx* is the most dominant species constituting the bulk of the population. *Photis digitata*, *Periocolodes longimanus* and *Ampelisca cyclops* are restricted to

barmouth area during high saline period. *A. zamboangae* which prefer higher salinities also occur in the estuary during high saline regime. Salinity is the major limiting factor in the distribution of gammarid amphipods in this estuarine system.

16. MYCTOPHID RESOURCES OF THE ARABIAN SEA AND BAY OF BENGAL

K. J. PETER

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Analysis of the catch composition of fish larvae collected during the International Indian Ocean Expedition from the Arabian Sea and Bay of Bengal revealed that Myctophidae outnumbered all the others. This was represented by a large number of genera and species. Among the various genera of myctophids, *Diaphus* had the highest abundance followed by *Lampanyctus* and *Diogenchthys*. *Symbolophorus*, *Hygophum*, *Notolychnus*, and *Myctophum* were the other common genera in the collection. *Ceratoscopelis* and *Scopelopsis* were rather rare. These larvae of lantern fishes are very peculiar and show great diversity of form

Published works on the larvae of Myctophidae of the Arabian Sea and the Bay of Bengal are very scanty. In the present collections, this family was represented in 70.8% of the stations of the Arabian Sea and the Bay of Bengal, contributing to 25.3% of the total larvae. The Arabian Sea recorded a higher percentage of larvae (26.8%) than the Bay of Bengal (20.8%), whereas the frequency of occurrence was vice versa, with 68.1% and 72.0% respectively. They are recorded in all months of the year both in the Arabian Sea and the Bay of Bengal showing that the breeding is continuous and prolonged in the group. They breed over extensive areas, mainly in the offshore and oceanic waters.

Myctophids are perhaps the most widely distributed family of fishes in the Indian Ocean as also in the other world oceans. This economically unimportant group, being abundant and widespread, serving at present only as a forage food in the ocean, is also a potential source of protein from the sea.

17. FLUCTUATIONS IN THE INTENSITY OF OCCURRENCE OF *MESOPODOPSIS ZEYLANICA* (CRUSTACEA, MYSIDACEA)

M. D. VARGHESE

Department of Aquatic Biology & Fisheries, Trivandrum

Many workers elsewhere have proved that mysids formed an important constituent of the diet of fishes. *M. zeylanica* is one of the common inhabitants of the estuarine waters of Kerala. Since this animal has been reported to be a preferred item in the food of *E. suratensis* it is essential to have a correct knowledge on the abundance of the former in order to predict the occurrence and consequent exploitation of the latter. As variations in environmental conditions have a direct bearing on the occurrence and abundance of this organism, an attempt was made to study the influence of these parameters. Twelve collections extending for a period of 12 months were taken from Veli lake. The animals were sorted out into six categories and the total number of individuals in each group were counted. Surface water samples were collected to determine temperature, salinity and dissolved oxygen. It was observed that *M. zeylanica* abounds in the lake under conditions of comparatively high temperature, moderate salinity and low rain fall. The population declines at very low salinities and also when the sand bar opens. Dissolved oxygen content of the water has no influence on the fluctuations in the population density or that it was never below the tolerable minimum.

18. ON THE MOLLUSCAN RESOURCES OF UTTARA KANNADA DISTRICT

B. NEELAKANTAN, U. G. BHAT, U. G. NAIK, K. K. PHILIPPOSE
& M. S. KUSUMA

Department of Marine Biology, Karnatak University, Kodibag, India

The molluscs form an important group of invertebrates of commercial value. Besides forming food, the molluscs are a useful resources in making lime, mortar and cement for the house building industry and as ornaments. Among such molluscs, in recent times, there has been growing interest to develop bivalve fisheries in places which sustain fairly adequate bivalve resources.

In the inshore waters and Kali estuary, the bivalves are comprised of edible mussel being represented by a species of *Perna viridis* and the clams embracing the species of *Meretrix casta*, *M. meretrix*, *Paphia malabarica* and *Vellarita cyprinoids* respectively are of wide occurrence.

While the edible mussel and clam fishery are ancillary in nature at present, they offer a very flourishing fishery throughout the year.

In the present paper, some aspects of the distribution of mussel and clam beds in and around Karwar, magnitude of the fishery and the need for starting systematic culture of edible mussel are highlighted. Above all, the necessity for educating the public on the value of the bivalves as a source of protein-rich food is stressed.

19. FIN FISH RESOURCES OF KARWAR

M. S. KUSUMA, R. SUDARSHAN, U. G. BHAT, M. V. PAI &
B. NEELAKANTAN

*Department of Marine Biology, Karnatak University, Kodibag,
Karwar,*

The marine and estuarine fisheries contribute over 35% of the total income of Uttara Kannada district in Karnataka. The Kali estuary located in the taluk of Karwar (14°51'N and 74°07'E) is the most important estuarine system and its fishery resources sustain a large industry in Karwar.

The paper gives a brief account of the fin-fish resources of the Kali estuary, past and some recent trends of *Lactarius lactarius* fishery and, the status of the fringe scale sardine fishery, its consistancy, potentially with catch and disposal in the district. Besides, the paper presents a case study at Karwar bay and arrives at a model of demersal production.

20. STUDIES ON THE POPULATION DYNAMICS OF FISH IN RIHAND RESERVOIR WITH ITS POTENTIAL ROLE IN HARVEST

RAVINDRA PRASAD, M. P. SAXENA & S. B. KULSHRESTHA

Fisheries Department, Bareilly

Rihand is one of the important reservoirs of Uttar Pradesh, located in the district of Mirzapur. The communication reports the fish and fishery resources in reservoir. *Catla catla* constitutes the major fishery in the reservoir. Three morphotypes of *C. catla* are encountered; one of the morphotypes feeds on phytoplankton and has better conversion ratio. During the course of studies for three years, it was observed that the population of the phytoplankton feeder morphotypes which is not supplemented by stocking in the reservoir, is constantly on the decrease. The declining trend of phytoplankton feeding of *C. catla* in the reservoir has an adverse effect on fish harvest and requires immediate attention.

21. FISHERY POTENTIALS OF SOME OF THE MAJOR RESERVOIRS IN TAMIL NADU

R. SRINIVASAN, FREDA CHANDRASEKARAN & S. AROKIASAMY

Department of Fisheries, Tamil Nadu, Madras

Reservoirs are valuable fishery resources, the management of which has assumed considerable importance in recent years in view of their major contribution to the inland fish production in our country. No two reservoirs are alike in their characteristics as morphological topographic, limnological and climatological parameters vary from reservoir to reservoir. These affect wide variations in fish production from reservoirs and in the case of reservoirs in Tamil Nadu the production ranges from 3 to 300 kg/ha/year. The causes for such wide variations and reasons for high production particularly in Sathanur and Bhavanisagar reservoirs are presented and discussed along with production in 8 major reservoirs.

Session II FISHING CRAFT

Date	:	25-11-1982
Time	:	11.00-13.15
Venue	:	CIFT Hall No. 2
<i>Chairman</i>	:	Shri S. Paramanandan Director General, Naval Design Naval Head quarters, New Delhi-110 011
<i>Keynote address</i>	:	Shri M. Jayaraj Director of Fisheries Karnataka, Bangalore



22. TRAWLER OPERATION, A SYSTEM ANALYSIS FOR THE DETERMINATION OF OPTIMUM PARAMETERS

RAJAT ROY CHOUDHURI

Calcutta Port Trust, Calcutta-700 001

Trawling is the most important method of fishing. The successful operation of a trawler depends on the close co-ordination of several variable factors that may be called operational factors, namely speed of the trawler both free running and while trawling, speed of the trawl winch when hauling the net, number of fishing trips per year, trawling cycle and hauls per trip. The operational factors are directly linked with the operational conditions such as distance of the trawling spot from the base and the depth which will in turn determine the optimum parameters of the fishing vessel and size of the trawl net to be used. The cost factors and returns on investment, the ultimate measure of the effectiveness of a trawler, are considered together with guidelines for the designer.

23. ASPECTS OF FISHING TRAWLER DESIGN

WALTER STOVHASE

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The ship design approach used in general is based on weight. In fishing trawler design, however the dimensions are dictated by the required volume. The possibility of designing a ship on the basis of a required internal volume is considered in general and an approach to the solution of the problem by the example of fishing trawlers.

The required volumes of the different spaces are determined from the required performances of the trawler in connection with catch, processing and transport of the fish. The necessary volume for these purposes is then compared with the available volume of a ship corresponding to its dimensions, thus determining the necessary main dimensions, like length, breadth, depth etc. of the vessel under consideration. The obtained dimensions are considered in connection with the initial stability, GM, necessary to ensure the required safety and sea-keeping properties.

The equations and coefficients required for the design of a fishing trawler are presented. The possible further development of the design procedure is discussed.

24. DESIGN AND CONSTRUCTION OF SMALL HARBOUR CRAFTS

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The paper, in general, deals with different aspects of design and construction of small harbour crafts. Various aspects to be taken into consideration while designing these crafts which are different from seagoing vessels. The reason being special duties and restricted conditions under which these vessels have to operate within the restricted waters. The construction materials, machinery, equipment, building technology standardisation and future trends in design and construction of small harbour crafts are also discussed.

25. EVALUATION OF VESSEL PROFITABILITY FOR OFFSHORE FISHING ALONG THE WEST COAST OF INDIA WITH PARTICULAR REFERENCE TO ACTIVE AND PASSIVE METHODS OF FISHING

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The scope for venturing into offshore fishing along the west cost of India has been discussed. The distance to the fishing ground has been determined considering the potential resources available and the catch estimates have been made based on the earlier studies made by several workers. A minimum size of 20 m long fishing vessel for a 10 days trip cycle has been suggested. It is proposed to construct the vessel with wood, being the cheap boat building material and utilizing the local boat building technology. It is suggested to use different power for the main engine namely 275 HP for long-lining and 400 HP for trawling making use of the same hull design.

The various costs for building a hull, main engine, deck machinery and other equipment have been estimated to calculate the total vessel cost. Similarly the costs of gear, maintenance cost, victuals, etc. have been estimated. Sharing percentage system is adopted to distribute the revenue among the owner and the crew. The major operating expenses like fuel costs have been considered as the common expenses.

The vessel profitability for both long-lining and trawling, the owner's net profit, man income, the required revenue per day for break even have been computed.

Sensitivity analysis have been made to determine the effect on the owner's net revenue and man income by changing the values of sharing percentage, vessel investment, fish price, fuel price and the gear quantity used per day fishing. The catch rate for break even also have been presented for the above main variable parameters.

Comparision of the profitability of long-lining and trawling in the offshore waters of the west coast of India has been made and the need to step into energy efficient methods of fishing like long-lining is stressed in this paper in view of the alarming increase in fuel cost and the scarcity of the same in the local market.

26. CORROSION CONTROL PRACTICES IN MARINE ENGINEERING

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The field of marine engineering involves an immense variety of structures, machinery and equipment, fulfilling widely diverse functions and operating under different environmental conditions. Sea water can be contaminated by chemical and biological pollutants; it can contain solid matter and floating debris and the salt concentration varies.

Steel is the only common structural material that is used for most marine structures because of its high strength. Corrosion, therefore, is not only an extremely important factor in the effective operation and life of marine structures but must be controlled to a minimum from different points of view such as economy, safety etc. In this paper the important factors, namely, salinity, oxygen content, organisms, temperature and velocity, responsible for corrosion of steel in sea water and the methods of protection by paint, metal coatings and cathodic protection are considered in detail.

27. USE OF COPPER BASE ALLOYS IN FISHING CRAFTS AND GEAR

M. VISWANATHAN & L. R. VAIDYANATH

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Copper and its alloys have been closely associated with marine applications as materials of construction, by virtue of their excellent resistance to corrosion by sea water and marine atmosphere. Recognition of the importance of anti-fouling characteristics, particularly in tropical sea waters, has further enhanced the importance of copper based alloys. A host of components of equipment and machinery for building sea going vessels, fishing trawlers, marine propellers, heat exchange tubes, boiler condensers, pumps, propellers, valves, sea water pipe lines, water boxes, marine hardwares and fasteners are fabricated from copper alloys. Practically all important copper based alloy sys-

tems find application in this area. In addition to the above well established areas of applications, imparting anti-fouling characteristics to the hulls of fishing crafts, which are required to function in warm sea waters, has been receiving great attention. Equally important are the developments in the use of cupronickel cages and nets in fish farming. Recent developments and future trends in the above areas are discussed.

28. CORROSION BEHAVIOUR OF METALLIC FASTENING IN CONTACT WITH WOOD

K. RAVINDRAN, A. G. GOPALAKRISHNA PILLAI &
R. BALASUBRAMANYAN

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The prohibitive cost of copper and copper base fastenings in boat building has necessitated the search for cheaper substitutes. The investigational work reports the evaluation of performance of fastenings made of iron, aluminium, galvanised iron, cadmised iron and aluminised iron in contact with (1) *Adina cardifolia*, (2) *Artocarpus hirsuta* (3) *Lagerstroemia lanceolata* (4) *Mangifera indica* and (5) *Tectona grandis* as well as timbers treated with arsenic-copper-chromate preservatives. The test programmes consisted of nearly hundred fastenings-wood combinations being prepared using either fastenings or specially prepared corrosion test cylinders and driving them to wood. An atmosphere of 100% humidity was maintained throughout. Quantitative data on corrosion and the comparative behaviour of fastenings are presented.

29. ON THE DESIGN AND FORMULATION OF ZINC RICH PAINT AND ITS EVALUATION BY ELECTROCHEMICAL AND OTHER ACCELERATED TESTS

A. G. GOPALAKRISHNA PILLAI & K. RAVINDRAN

Central Institute of Fisheries Technology, Cochin-682 029

The concepts of protection of marine structures by applying inorganic zinc coating have revolutionised the anticorrosion technology. The heavily pigmented zinc rich paint apart from acting as a barrier,

affords cathodic protection by maintaining electrical continuity through the paint film to the underlying metal. Several formulations of cementsiferous paints based on alkalisilicate, finely divided zinc dust and fillers were made. Those which passed the screeing test as regards to adhesion, hardness and flexibility were further tested for their electro-chemical characteristics. The most promising compositions were evaluated through a series of tests like accelerated salt spray test, monitoring electrode potential of substrate metal, cell voltage measurements and field tests. Data relating to formulations and test results are discussed.

30. WOOD PRESERVATION PRACTICES FOR MARINE APPLICATIONS

SATISH KUMAR

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Despite the fact that timber is one of the most favoured material for most marine constructions, its preservation against marine borer attack has rather been neglected by the users. The early accent has been on more durable traditional timbers like teak, green heart, when the supply was plenty. These timbers being is short supply now, other species are extensively being used but without proper preservative treatment. Although definite durability data under marine conditions of most of these species are not known, test; on preservative treated timber have clearly favoured the use of preserved wood over untreated nondurable and even durable woods. The list of species commonly being used/recommended for various marine applications, their physical and mechanical properties, durability and treatability behaviour as available from various studies in the country are reported. Full cell process with copper-chrome arsenic/creosote: coal tar mixtures have been recommended for treatment of marine timbers. Economics of treatment with respect to savings in money value as well as wood requirements in the country have been worked out to demonstrate the ever increasing importance of wood preservation.

31. PRESERVED AND KILNED MANGO TIMBER-AN EXCELLENT SUBSTITUTE TO TEAK

V. R. SONTI

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Teak is and has been the best known timber used in the manufacture of marine craft. Today, good teak is just not available for this purpose. After extensive research it has been found that Mango (*Mangifera indica*) when properly pressure impregnated with Ascu or CCA salts and kiln dried as a good substitute for marine craft in place of teak. Quarter sawn and kiln dried mango showed remarkable stability. Mango wood is readily available. This paper discusses briefly the inspection procedure for mango logs, quarter sawing procedures to be followed and kilning. Type of preservative pressure treatment processes are highlighted.

32. WOOD PRESERVATION-AN APPROPRIATE TECHNOLOGY FOR THE USE OF THE SMALL SCALE FISHERMEN

N. UNNIKRISHNAN NAIR, A. G. GOPALAKRISHNA PILLAI,
K. RAVINDRAN & R. BALASUBRAMANYAN

Central Institute of Fisheries Technology, Cochin-682 029

Indian fishermen use small boats and catamarans for fishing. For catamarans timber species of light weight such as *Melia composita*, *Albizia mollucana*, *Bischofia javanica* and *Erythrina* sp. are widely employed. The built in canoes of the Kerala coast called "Thanguvallam" are made out of jungle jack (*Artocarpus hirsuta*). The fishermen operate nearby 106,000 indigenous crafts as per a recent estimate. Due to biodeterioration, these indigenous crafts have to be repaired or replaced every two to seven years which results in huge investment of money. The cost of a Thanguvallam of 48' OAL is approximately 12,000 to 15,000 rupees. The indigenous crafts contribute to about 62% of the total fish landings of the country. Thus the indigenous fishing crafts and their deterioration are of considerable economic importance and makes the prevention of these losses an important problem of the Indian fishing industry.

The fishing crafts are used either during the day or in the night and when not in use are kept on the beach exposed to air, sun and rain. Alternate wetting and drying of these wooden crafts pose innumerable maintenance problems and ultimately reduce their effective service life. Fungus infection has been identified as the main root cause of bio-degradation followed by weathering action. The fishermen resort to certain indigenous methods of preservation of their crafts. The disadvantages of this method and the economic gain and better efficiency gained by gradually adopting to chemical treatments and certain developmental work carried out in this direction at the Central Institute of Fisheries Technology are highlighted in this communication.

33. COPPER CREOSOTE—A NEW PRESERVATIVE FOR MARINE WOODEN STRUCTURES

**K. RAVINDRAN, N. UNNIKRISHNAN NAIR &
A. G. GOPALAKRISHNA PILLAI**

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The affinity of certain components in creosote towards inorganic salts was explored. Copper oxide on heating produces stable compounds which are found to be biologically active. Data regarding preparation of copper creosote, preservation treatment and field test are presented. Comparative data on the performance of creosote, arsenical creosote, copper creosote and TBTO-fuel oil mixture are presented. Data relating the evaluation of the effectiveness of preservatives by bending modulus test are also presented.

34. ELASTOMETRIC ANTIFOULING ANTIBORING COATING — A NOVEL APPROACH

K. RAVINDRAN, RANY MARY JACOB & N. UNNIKRISHNAN NAIR

Central Institute of Fisheries Technology, Cochin-682 029

Under favourable conditions, certain objects on immersion in sea water are subject to both boring and fouling. In this communication, the development of coating which would ward off both foulers and

borers simultaneously is presented. Tough coatings based on melamine treated cashewnut shell liquid, polymerised rubber with carbon additives, polyester gel coat without fillers were developed for the purpose. Based on studies regarding packing characteristics and particle size, silicon carbide in a finely divided state was introduced into the matrix with a view to create a condition that is hostile to marine borers. The antifouling properties were provided to the matrix by introducing tributyl-tin-oxide. Details of the design of the coating and means of continuous maintenance of the leaching rate are presented. Data relating to field studies are also given.

35. INVESTIGATIONS ON SELECTED MECHANICAL PROPERTIES OF FERROCEMENT AND POLYMER INCORPORATED FERROCEMENT

P. N. JOSHI, K. RAVINDRAN

Central Institute of Fisheries Technology, Cochin-682 029

&

A. J. P. NAMBOODIRI

M. A. College of Engineering, Kothamangalam-686 691

The mechanical strength properties of ferrocement were investigated with reference to uniaxial tension, compression and flexure from deflection, cracking and ultimate strength. The effects of impregnation of polymer and that of incorporation of fly ash in ferrocement and the mechanical properties were studied. The data were further analysed in relation to specific surface area and reinforcement factor. The failure modes of impregnated and unimpregnated ferrocement are also discussed.

Session III FISHING GEAR AND METHODS

Date	:	25-11-1982
Time	:	14.15-17.15
Venue	:	CIFT Hall No. 1
<i>Chairman</i>	:	Shri K. M. Joseph Director, Exploratory Fisheries Project, Bombay-400 001
<i>Keynote address</i>	:	Dr. W. Dickson Bath Lodge, 6, Bath Street, Stone Haven, Scotland

36. STUDIES ON INDIGENOUS FISHING GEAR—THANGUVALA—INTRODUCTION OF KNOTLESS WEBBING AND ITS OPERATION FROM MOTORISED CRAFTS.

P. GEORGE MATHAI, T. P. GEORGE AND A. C. KUTTAPPAN

Central Institute of Fisheries Technology, Cochin-682 029

Thanguvala (single boat seine) is an artisanal fishing gear operated along the south west coast mainly for surface shoaling fishes like sardine, mackerel and white bait.

Field trials were conducted with the thanguvala made of knotless webbing from a traditional craft powered by Greaves Lombardini inboard - outboard/Yamaha outboard motor during 1980-81. Data covering all the important fishing parameters were collected and analysed. The results show the advantages of motorisation and the better efficiency of the gear made of knotless webbing.

37. ON THE SCOPE RATIO STUDIES IN TRAWLING OFF KAKINADA (A.P.) ON THE EAST COAST OF INDIA

A. V. V. SATYANARAYANA, K. GOPALAKRISHNAN & S. V. S. RAMARAO

Kakinada Research Centre of Central Institute of Fisheries Technology, Kakinada-533 003

Experimental fishing was conducted off Kakinada on the east coast using 20 m bulged belly four seam type and 20 m six seam using suitable flat rectangular otter board and double sweeps on either side of the gear and scope ratio studies were attempted between 10 to 50 m depths and

concerned data on catch, horizontal opening and warp tension are presented. The data revealed that for successful operation upto 20m depth the warp should be 7 to 8 times the depth of operation. Between 20 m and 50 m depth ranges scope ratio of 1:6 and 1:5 appear to be most suitable. For operation above 60 m depth, the warp to be released may be four times to the depth.

38. AN ACCOUNT OF TRAWL FISHING OFF KAKINADA

G. NARAYANAPPA, S. V. S. RAMARAO, J. SITARAMARAO,
R. M. NAIDU & A. V. V. SATYANARAYANA

*Kakinada Research Centre of Central Institute of Fisheries Technology,
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In the present communication the authors have reviewed the trends of bottom trawling for the last one and half decades off Kakinada. Performance of various designs of trawls both two-seam and four-seam was also assessed. On an average the catch rate was found to be 33.3 kg/h. The five yearly landings were worked out for three periods, 1967-71, 1972-76 and 1977-81 at different depth ranges off Kakinada. The analysis reveals that 1967-71 period to be the most productive. There is considerable reduction in the catch per unit effort during 1972-76 and 1977-81 periods. The catch rate was lowest during 1977-78. An attempt is made to correlate the catch with the increase in fishing fleet from year to year.

39. ON THE RELATIVE EFFICIENCY OF MEXICAN AND CONVENTIONAL OTTER BOARDS

S. V. S. RAMARAO, G. NARAYANAPPA, J. SITARAMARAO
R. M. NAIDU & A. V. V. SATYANARAYANA

*Kakinada Research Centre of Central Institute of Fisheries Technology,
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Comparative efficiency studies of Mexican and conventional otter boards are presented. The average catch per hour of the net fitted with rectangular flat otter boards and Mexican boards worked out to

15.3 and 15 kg respectively. The net gave more horizontal spread (42.2%), while operating with rectangular otter boards in contrast to Mexican boards (37%). Significant variation is not seen in respect of resistance. Both the otter boards were seen operating within the normal range of angle of attack and tilting outwards slightly.

40. STUDIES ON HIGH OPENING TRAWL—RELATIVE EFFICIENCY WITH BULGED BELLY TRAWL

**G. NARAYANAPPA, S. V. S. RAMARAO, J. SITARAMARAO
R. M. NAIDU & A. V. V. SATYANARAYANA**

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Results of the experimental fishing carried out with a high opening trawl for catching bottom and off bottom fishes during February 1979 to December 1981 along with a bulged belly trawl are reported. High opening trawl gave 1.67 times higher catch rate than bulged belly trawl. Off bottom fishes like *Trichiurus*, *Silver bellies* and *anchovies* formed 40% of the total catch in high opening trawl while it was 20% in bulged belly without much difference in the catch per unit effort of other groups of fishes.

41. ON THE COMPARATIVE EFFICIENCY OF THREE DIFFERENT TRAWLS SUITABLE FOR THE EXPLOITATION OF THE SHALLOW WATER MIX

**N. SUBRAMONIA PILLAI, R. S. MANOHARA DOSS, V. VIJAYAN,
C. HRIDAYANATHAN & S. GOPALAN NAYAR**

Central Institute of Fisheries Technology, Cochin-682 029

The results of the comparative efficiency of three different trawls namely, bulged belly, six seam and high-opening trawl are presented. Studies showed that bulged belly trawl as more efficient for catching shrimps, six seam and high opening trawls for the capture of bottom and column fishes. Six seam and high opening trawls offered comparatively lesser resistance and developed better vertical opening and hori-

zontal spread. It was less adaptable to the sea bottom compared to bulged belly and limited the catch of shrimps. For successful fishing in a ground rich in prawns, bulged belly is more suitable and for grounds dominated by fishes either six seam or high opening trawl can be operated.

42. CATCH EFFICIENCY OF TRAMMEL NETS IN RELATION TO TWINE SIZE AND HANGING COEFFICIENT

R. M. NAIDU

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The trammel nets are noted for exploitation of fishes in sparsely populated water bodies. To effect proper gilling, entangling and retaining of fishes in the gear, correct twine size and hanging coefficient are to be selected. In view of the above, trammel nets with inner webbing made of nylon 210/1/3 and 210/2/2 and horizontal and vertical coefficients of 0.4/0.8, 0.4/0.6, 0.5/0.8 and 9.5/0.6 are used in this experiment. The mesh-size ratio of inner and outer webbing was kept 1:3. It is concluded that the relatively thicker twines of inner webbing and normal hanging coefficients (0.5/0.8) to be better for the exploitation of fishes in the Hirakud reservoir.

43. A NEW FISHING GEAR FOR TRADITIONAL CRAFT

P. A. PANICKER, T. M. SIVAN & N. A. GEORGE
Central Institute of Fisheries Technology, Cochin-682 029

Results of experimental fishing conducted with a low cost two boat purse seine of 250 x 33 m size from two non-mechanised traditional fishing craft (Thanguvallam) at 10 to 20 m depth, off Chellanam with the help of fishermen are presented. The net landed an average 2.5 to 3.5 tons of anchovies and sardines and 0.8 to 1 ton of mackerel per day. Optimum capacity of the new gear is 5 tons per each operation. On an average, time taken for shooting the net was 2.5 to 3 min, pursing 5-6 min, and hauling 15 to 30 min. A total of 20 men are required of which 9 each are distributed in the purse seiners and 2 in the carrier vessel. The study shows that the age old artisanal fishing can be improved by resorting to the method under report.

44. FISHING GEAR AND METHODS OF FISHING IN VEMBANAD LAKE

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The existing fishing methods of the Vembanad lake can be classified under three major categories, namely, (1) net fishing (2) line fishing (3) miscellaneous methods. Based on the construction and mode of operation, the fishing gears falls under 5 major classes, namely, drag nets, bag nets, gill nets, fixed (stake) nets and cast nets. The different major classes were divided into sub-classes based on the difference noticed in the gear specification such as length, width, mesh size and material used. Details regarding the catch composition of different types of gears and methods, fishing methods of different sectors of the lake and time and season of operation of different types of gears in the lake are incorporated. The adverse impact of stake net fishing on the fisheries resources of Vembanad lake is discussed.

45. OBSERVATION ON THE VERTICAL LONG LINES OPERATED OFF COCHIN

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Experimental vertical long line fishing were conducted in the sea off Cochin for the first time to find out the swimming layer of sharks with a view to operate long line at a particular depth. Fishing with lines was conducted at depths ranging from 15 to 30 m. Totally 2050 round bent (No. 6 to 10) mustard hooks were used and 348 sharks were landed. Data on the availability of sharks in different swimming layers revealed that the concentration of sharks are comparatively high at depths between 16 to 20 m.

46. FISH AGGREGATION BY RAFT

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This communication reviews and evaluates different types of fish aggregating techniques in vogues in different parts of the world such as Brush Wood fishery, Log fishing, Kanizzati fishing, Payao fishing and Raft fishing. These aggregation techniques act as biological accumulations thereby enhancing the efficiency of various fishing techniques. Concentration of fish around and below the rafts are due to the need for shelter or for optical orientation, or provision of food or availability of prey or an allure of the low frequency vibrations produced by movements of the luring lines. This method benefits artisanal and commercial fishermen by way of increased fish production, relieves them from the need for live bait, helps to conserve fuel and save effort by decreasing, the amount of time spent in 'Scouting fish.' With slight improvements, the methods can be adopted for India.

47. THE LURE AND LIFT NET FISHING TECHNIQUES OFF COROMANDAL COAST, TAMIL NADU—INDIA

V. C. GEORGE

Central Institute of Fisheries Technology, Cochin-682 029

Attraction and concentration of fishes with present lure lines and their subsequent capture by lift nets are practiced along the Coromandal coast of Tamil Nadu (Nagapatnam to Pulicat). The present study relates to the design, construction and operation of this fishing gear and method. Major variations in nets of different areas with reference to mesh size, design and mode of operation are also enumerated. It is seen that in certain instances fishing lure line are not employed while in certain cases divers are employed to guide or lead the fish into the net. The inter-relationship between the different parts of the net has been worked out and positive correlations obtained irrespective of mesh size and dimensions. The significance of this fishing technique as a prelude for development of fish aggregation devices is also stressed.

48. TRENDS IN RESERVOIR FISHING TECHNOLOGY RESEARCH IN INDIA

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The various investigations undertaken so far enabled to identify various problems pertaining to harvesting of the fishery resources. The potential areas in different areas have been located and suitable gear for the exploitation of both Gangetic carps and other uneconomic species evolved. It was established that synthetic gear was superior to cotton nets. Experiments with simple gill nets and entangling nets proved that the latter is more efficiency than the former. Active gears like trawls and shore seines could be operated in reservoirs. This technique apart from increasing the yield facilitated eradication of unwanted fishes. The research so far undertaken have helped to solve many of the problems confronted with exploitation of reservoir fishery resources. However the technique developed has to be transferred to other reservoirs with suitable modifications.

49. TWO-BOAT MIDWATER TRAWLING ALONG THE SOUTHWEST COAST OF INDIA

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Central Institute of Fisheries Technology, Cochin-682 029

Due to the addition of large number of mechanised fishing fleet every year, the catch per unit effort has gone down considerably and shrimp trawling in inshore areas became uneconomical. To tide over this situation, efforts are to be made to introduce and popularise other fishing methods like mid-water or pelagic-trawling for semi-pelagic species and purse-seining for pelagic species for economic operation of smaller boats in the inshore regions. As an effort towards diversification, the authors have taken up studies on two boat midwater trawling from two identical boats of size 31.5 ft (9.6 m), fitted 80 HP Leyland engine. The fishing gear designed for the operation is four-panel rectangular net of 18.5 m HR size of 0.75 mm. polyethylene webbing. Special

type of rigging is adopted by providing long sweeps made of 16 mm dia. polyethylene rope of 36 m length for HR and 37 m length to FR in between the legs and the towing warps for two vessels. The fishing operations were carried out at two depth ranges in between 5-20 m and 21-35 m off Cochin during the period from June-August 1978 and the total catch recorded was 23,879 kg and 28,856 kg respectively from the two regions. Analysis of the catch data showed that the average catch per day and the value realised were Rs. 2,101.33 for 1591.93 kg and Rs. 2,663.75 for 1697.41 kg respectively. From the foregoing account, it can be observed that midwater trawling from two boats seems to be promising techniques for economic operation of mechanised boats, since the catch fetches a good price during lean monsoon months of June to August.

50. DEVELOPMENT OF SPLIT BELLY TRAWLS

K. N. KARTHA, T. P. GEORGE & K. A. SADANANDAN
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Two types of split belly trawls made of 12 and 8 triangular pieces with higher horizontal and vertical spread were evolved for prawn and fish respectively. Care has been taken to effect optimum economy in the use of materials of trawls without any way sacrificing the catching efficiency of the net. The result of the comparative fishing operations conducted with a popular trawl and two types of split belly trawls of 17 m head rope length indicated that the 12 piece split belly trawl is relatively for the capture of prawns and 8 piece split belly trawl for fish. The percentage of prawn in average catch h⁻¹ by using 12 piece split belly trawl is 150 and fish for 8 piece split belly trawl is 70. Between nets it is also found that 36% and 46% material can be saved for the construction of 12 piece and 8 piece split belly trawls respectively when compared to the popular trawl used for the studies.

51. MIDWATER TRAWLING—A REVIEW

K. N. KARTHA

Central Institute of Fisheries Technology, Cochin-682 029

Midwater trawls also known as floating or pelagic trawls have been successfully introduced in commercial fisheries by many countries since world war II to exploit large concentrations of shoaling fishes available in column waters. Based on the method of operation, it can be classified as one-boat and two-boat midwater trawls.

The development of midwater trawling took place in two stages. The first stage was during 1940's and 50's when the acoustic search devices were developed. In 1948, Larsen for the first time introduced a two-boat type "atom" trawl which became very popular in other countries.

The second stage was the development of one-boat "aimed" midwater trawling during 1960's when the control devices for trawl operations were invented and two-boat system was not acceptable for larger trawlers. After conducting series of a studies Barracough and Needlec, boat midwater of equal and unequal panel in combination with two door, four door and suitable other accessories for developing maximum horizontal and vertical spread.

Eventhough midwater pelagic fishing is an established commercial fishery elsewhere, little work has been done in India. Lack of adequately powered vessels, electronic aids and adequate research support seems to have come in the way of its adoption on a commercial scale in Indian waters. With a view to study the feasibility of adopting midwater pelagic fishing as an alternative method to bottom trawling as well as for economic running of smaller boats in the inshore area, experimental one-boat midwater trawling was first carried out in India by Perumal & Sreeram in 1966. This is followed by Sivan *et al.*, 1970; Kartha & Sadanandan, 1973; Mhalathkar *et al.* 1975 and Varghese, 1975 & 1977. Varghese & Nair, 1975 and Kartha & Sadanandan conducted midwater trawling from two-boat and suggested this method as a promising technique to be adopted in Indian fisheries.

Although intensive experimentation is being carried out, the design, construction and operation of midwater trawl differs widely from ground

trawls and it is still in a stage of development. Further this method has not been commercially introduced in many parts of the world due to variations in the behaviour characteristics of fish. The most profitable line of future development is to evolve a dual purpose gear that can be worked on or off to sea bed with suitable electronic aids for locating species which habitually moves between the bottom and midwater.

52. FISHING EXPERIMENTS WITH NEWER GEAR MATERIALS

K. RADHALAKSHMI & S. GOPALAN NAYR

Central Institute of Fisheries Technology, Cochin-682 029

Results of two sets of fishing experiments, one comparing nylon monofilament and nylon multifilament fine gill nets for mackerel fishing and the other HDPE tape twines and nylon multifilament twines for heavy gill nets used for multispecies like tuna, seer, and shark are presented. Data for twenty fishing trips under the first series and sixty fishing trips under the second series are discussed. The studies indicate the possibility of replacement of the existing nylon with the newer materials under study.

53. A LOW COST CIRCULAR HATCHERY FOR CHINESE AND INDIAN MAJOR CARP SEED PRODUCTION

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For better utilisation of inland water resources and harvest of fish, there is a need for large scale fish seed production of fast growing Chinese and Indian carps. For this, a low cost circular hatchery has been designed, installed and operated successfully by the author. It is simple, economical and easy to operate. The details of its construction, operational technique and results of fish seed production from it has been given with economics which can be adopted by fish farmer with minimum cost and labour force in a limited space.

54. HARVESTING OF ANCHOVIELLA

T. A. MAMMEN & M. D. MENON

Tropical Fisheries Consultancy Service, New Delhi-110 032

The stagnation of marine fish production in recent years has raised doubts as to whether limits of sustainable yields have been reached. While there are indications that production from conventional sources is fast approaching a saturation point, resources like anchoviella offer tremendous scope for exploitation. The investigations of the erstwhile fisheries project have given a clear picture of the extent of resources and their distribution in time and space. However, in the absence of information on the type of craft and gear required for economic operation as well as economics of fish processing this resources is still languishing. A recent study by the Tropical Fisheries Consultancy Services has revealed that it is possible to exploit the anchoviella concentration in the Gulf of Mannar during the south-west monsoon period with medium vessels equipped for mid-water trawling. Beyond this period the resources are along the Malabar-Karnataka coast where it can be exploited with fine mesh purse seine nets, provided of course safeguards are taken to see that this fine mesh purse seine net is not used for fishing for juveniles of mackerel and sardines.

55. POLYPROPYLENE NETTING YARNS

S. GOPALAN NAYR, K. RADHALAKSHMI & B. MEENAKUMARI

Central Institute of Fisheries Technology, Cochin-682 029

Fine netting yarns made of continuous multifilament polypropylene manufactured in India are evaluated for their properties like diameter, weight per metre, twist, strength, wet knot strength, deterioration due to UV and outdoor exposure tests. The values are compared to nylon multifilament twines at present used by the fishing industry. Studies indicate that polypropylene multifilament twines can be substituted for nylon on an equal diameter basis for certain types of gear which will result in savings of material by about 10%.

56. METHODS OF HARVEST IN ENCLOSED CULTURE SYSTEMS

R. MARICHAMY, & S. RAJAPACKIAM

Tuticorin Research Centre of Central Marine Fisheries Research Institute, Tuticorin - 628 011

The paper describes the features of harvesting techniques of the fish culture system including the traditional culture practices. Nets of various designs and mesh sizes are used for handling larvae, fry, juvenile, growing stock and adult fishes, prawns and crabs. The harvest of the farmed fish differ according to the nature of the culture system, sizes of the cultured species and season of capture. Draining of the pond is found to be more perfect for successful harvesting besides other advantage as it promotes culture practices by way of eradicating unwanted species, fertilising the pond, strengthening the bunds and sluices and permitting new controlled stocking. The presence of radiating drain lines in the pond and the incorporation of harvest basin near the outlet sluice greatly facilitate the harvesting of ponds. Dip netting is used after allowing the fish to concentrate in harvest basin in the course of final drainage of the pond. Harvesting is comparatively easy when single size stocking is practised. The traditional culture practices followed in salt pan reservoirs have the strategy of selective harvesting or multiple harvesting of marketable fish by gill nets of bigger mesh size. The height of the net is about 1.8m and in operation a number of nets each about 20 m length are joined together and towed across the length of the huge pond. Thinning of the fish population by frequent partial cropping leads the stock to grow and to give a better yield.

Prawns are caught by placing a net at the outlet sluice gate to take advantage of the habit of the shrimp to swim with current. Crabs are captured from ponds by using hoop net or dip net made with cycle rim baited with gill rakers. Gill nets, trap nets, seives and cast nets are widely used for catching fish without draining. The stake net is a kind of seive net provided with a medium purse to increase its catching potential mounted with mangrove stick at intervals between balks and used in fishing from the ponds. The problems faced in fishing methods are also discussed briefly.

57. STATISTICAL STUDIES ON GEAR EFFICIENCY

A. K. KESAVAN NAIR

Central Institute of Fisheries Technology, Cochin-682 029

&

K. ALAGARAJA

Central Marine Fisheries Research Institute, Cochin-682 018

In this paper, it is indicated that there exists a critical number above which the relative efficiencies are discernible and below which, it is not possible to indicate whether one gear is more efficient than the other. This region where indication of relative efficiency is not possible, is termed as null region. The concept of null region and evaluation of N_c , the critical number is dealt with and a mathematical model is found using stimulation technique. In case of effective region, method of comparing efficiencies is pointed out.

58. ON THE PERFORMANCE OF BULGED BELLY TRAWLS FROM LARGER VESSELS

C. HRIDAYANATHAN & K. N. KARTHA

Central Institute of Fisheries Technology, Cochin-682 029

The authors conducted fishing during 1972 between Cochin and Quilon in depth 30 to 80 m. Two bulged belly trawls of head rope 40 m, single straight jib and 50 m double slanting jib type in combination with rectangular flat wooden otter boards of 245 x 100 cm weighing 174 kg each were operated from 'R. V. VARUNA' (28 m OAL, 400 HP). The same nets with similar type of otter doors 200 cm x 123 cm weighing 425 kg each were also rigged for the study from 'BLUE FIN' (28.35 m OAL, 600 HP). A study was also conducted to correlate the influence of the environmental parameters to the prawn catch obtained. Samples of sea water and bottom deposits were collected from the same depth

where the above nets were in operation for estimating the salinity, oxygen content sediment composition and benthic fauna. Results of the foregoing study are summarised below.

1. The catch/h of fish was worked out separately for each vessel and found to be 350 kg, 355 kg. for 50m net and 123 kg, 82.50 kg for 40 m net. Out of the two nets compared 50 m net yielded 3-4 times more catch than that of 40 m net showing that double slanting jib is suitable for bulged belly trawl.
2. There was significant increase in prawn catch when the two nets were rigged with heavier standard sizeed of otter doors. The percentage composition in the average catch/h is 60 for 50 m net and 46 for 40 m net. A maximum value of 6 ml/of oxygen was recorded from the ground where *Penaeus monodon* was caught. The sand content was highest in all the stations indicating that *Penaeus monodon* prefers the sandy ground unlike that of *Metapenaeus dobsoni* and *Parapenaeopsis stylifera*. *Penaeus indicus* were recorded from sandy ground as well as from the region where the percentage of silt and clay is more. The analysis of the bottom fauna indicated the presence of annelids, crustaceans and molluscs. The maximum number of annelids have been recorded at 35 m depth. Further the percentage composition of different group indicated that the polychaetes formed an average of 75.5 %. Crustaceans varied from a minimum of 0.8 to 46.15% while molluscs varied from 1.3% to 31.4%.

60. SYNTHETIC FIBRES IN INDIAN FISHING INDUSTRY

P. J. CECILY & K. RADHALAKSHMI

Central Institute of Fisheries Technology, Cochin-682 029

The paper deals with the properties of synthetic fibre twines such as nylon, polyethelene, polypropylene which are the three main groups of fibres manufactured in India for making fishing gear. Selection of material for different types of gear with particular reference to conditions prevailing in India is discussed.

61. AN APPRAISAL OF TWIN-TRAWLING WITH SLED ALONG THE EAST COAST

S. V. S. RAMARAO, A. V. V. SATYANARAYANA, J. SITARAMARAO,
R. M. NAIDU & G. NARAYANAPPA

*Kakinada Research Centre of Central Institute of Fisheries Technology,
Kakinada-533 003*

Double-rig, double-twin-rig and triple rig trawling methods have all over the world. This paper deals with the efforts of the authors to operate one set of trawl gear (2 nets) from a single cable from a 12.2 m O.A.L. vessel with a pair of otterboards and a sled in the centre. Besides catches, horizontal spread and warp tension were also recorded. The average horizontal spread of two 10 m nets worked out to be more by 39% than that of 20 m bulged belly trawl. The tension by the two small nets is 10% less than the double the size single-rig trawl.

The performance of the gear was good throughout and besides prawns many other demersal varieties constituted main catch. The catch per hour of two nets together is 29.24 kgs out of which prawns form 8%.

62. SOME OBSERVATIONS ON DEEP SEA FISHING TRAWLERS FOR INDIAN WATERS

K. M. JOSEPH

Exploratory Fisheries Project, Bombay-400 00

Indian fishing industry for the last 2 to 3 decades has been shrimp oriented, even though shrimp accounts to only 12% of Indian's marine fish landing. Introduction of small sized shrimp trawlers and 70 outrig-

ger shrimp trawlers during the past two decades has not made any significant increase in prawn catch. Sea fish landing has also fluctuated at about 14 lakh tonnes during the last two years. This necessitated greater exploitation of deep sea resources. The type and size of the vessels needed for the exploitation of the deep sea fishes and economic viability of deep sea fishing have been debated. In the present paper, the author analyses the important factors. such as 1) fishery resources 2) Oceanographic conditions of the fishing ground 3) distance of the ground to the nearest fishing harbour 4) infrastructural facilities for processing, storage and marketing which have important bearing in determining the size and type of trawlers needed for deep sea fishing. After examining these factors the author suggests combination trawlers in the range of 200–300 GRT capable of carrying out mid water/pelagic trawling besides bottom trawling for Indian waters.

Session IV

**MACHINERY, EQUIPMENT &
INSTRUMENTATION**

Date : 25-11-1982

Time : 09.00-11.00

Venue : CIFT Hall No. 2

Chairman : **Shri P. U. Cariappa**
General Manager,
Cochin Shipyard Ltd.,
Cochin-682 015

Keynote address : **Shri M. Swaminath**
Director,
Central Institute of Fisheries
Nautical & Engineering
Training,
Cochin-682 016

63. HIGH SPEED ENGINES FOR SMALL CRAFTS

V. K. IYER

Greaves Lombardini Ltd., Aurangabad-431 003

The efficiency of fishing industry needs to be improved in view of the prospects. Various schemes are being put into operation. One of the important scheme thought of is to provide power plant to the small crafts. This will speed up the movements of fishermen and catch collection will be boosted up.

The power plant or engine needed for this operation has very specific requirements. Some of these are high speed, light weight and economical operation. The sea corrosion resistance should not be forgotten since this is the life limiting factor for any equipment. The author reports on a power plant that is being developed at Greaves Lombardini Ltd. that would meet the fore-mentioned requirements. Tests have proved the economical operation of the marinised engines.

64. ASHOK LEYLAND MARINE DIESELS—THE FISHERMEN'S COMPANION

B. MUTHUKRISHNAN

Ashok Leyland Limited, Ennore, Madras-600 057

The salient features of three versions of marine diesel engines: ALM 370, ALM 400 and ALM 680 manufactured by Ashok Leyland for powering the fishing boats are described. Improvements in design, engineering and manufacture as regards hardened liners for reducing wear

and tear, integral construction of crank case and cylinder block, water cooling systems, fuel injectors, combustion features and fuel economy measures are outlined. A brief account of the future development programme covering improvements in propulsion systems twin engine installation and hydraulic gear boxes with a view to increase the overall efficiency of the marine diesel engines for use in fishing boats is also included.

65. MECHANISATION OF TRADITIONAL FISHING VESSELS IN THE SOUTH WEST COAST OF INDIA

S. AYYAPPAN PILLAI

Central Institute of Fisheries Technology, Cochin-682 029

The paper describes the various stages of development in the mechanisation of traditional fishing vessels in the south west coast of India. Both imported outboard motors using petrol-kerosene engine and indigenously developed inboard-outboard drive units using diesel power have been tried to mechanise the traditional craft. The salient results of mechanisation of traditional craft are discussed in the paper.

66. DEVELOPMENT OF A FISH PUMP

K. SREEDHARAN NAMBOODIRI

Central Institute of Fisheries Technology, Cochin-682 029

Pump fishing techniques can be applied to all shoaling fish or in a fish shoal which is created by some attraction method. The normal centrifugal pumps, and reciprocating pumps have moving parts inside the pump and therefore the fish pumped get damaged. The author describes the development of a fish pump which works on the principle of pressure difference created by compressed air-water mixture. The accessories required for installation on boat are also described.

67. DEVELOPMENT OF AN AQUATIC WEED HARVESTER

K. SREEDHARAN NAMBOODIRI & M. VELU

Central Institute of Fisheries Technology, Cochin-682 029

Aquatic weeds both floating as well as submerged pose a serious problem to agriculture, fisheries and navigation. Removal of weeds by chemical and manual methods have limitations. Mechanical method are better where the population and area are more. CIFT has developed a weed harvester which can remove the weeds from an area of one acre per day. The machine consists of a moving rakes installed on a floating platform. The floating platform consists of five seperable steel tanks which are bolted together. The paper describes the fabrication of the weed harvester and its operation.

68. ELECTRONIC INSTRUMENTS FOR TESTING AND STANDARDISATION OF FISHING CRAFTS

T. K. SIVADAS, K. RAMAKRISHNAN & K. VIJAYABHARATHI

Central Institute of Fisheries Technology, Cochin-682 029

Electronic instruments have been developed indigenously for monitoring the performance of fishing crafts in view of estimating their suitability to different types of gear and load conditions. Three types of instruments are reported namely bollard pull monitor, speed and distance log and warp load meters. The bollard pull monitor monitors the bollard pull of boats during the bollard pull tests which is the standard test for assessing the capacity of the engine at different rpm. The instrument senses the bollard pull by means of its load cell and displays the bollard pull in tonnes in a meter kept at a convenient place connected by a two-core cable. A potentiometric recorder to which the signals are fed from the instrument, not only makes permanent records of the bollard pull in graphical form, but also reveals the nature of the power developed clearly. The speed and distance log indicates the speed of motion of the vessel and the total distance travelled. This instrument is needed for assessing the dynamic performance of the craft. The data from the meter can be fed to recorder for permanent records

and precise analysis. Two types of warp load meters are reported namely portable warp load meter for uses in smaller boats upto 100 kgs. and ship-installed warp load meter for permanent installation in large vessels for measurements upto 5 tonnes. The former can be used in all types of boats within the measurement range much easily without disturbing the routine fishing operations. The design and installation of the latter depends on the facilities on the deck in large vessels. Both of them have got facilities for feeding the signals to recorders for precise data analysis. All the instruments are fully indigenous and have been released for commercialisation. Some typical data obtained from the instruments during the static and dynamic tests are presented.

69. ELECTRONIC WIRE TELEMETERING INSTRUMENTS FOR THE ENGINEERING STUDIES OF OTTER TRAWLS

T. K. SIVADAS, K. VIJAYABHARATHI & K. RAMAKRISHNAN

Central Institute of Fisheries Technology, Cochin-682 029

A set of wire telemetering type instruments have been developed for measuring the various parameters and assessing the performance of the fishing gear in dynamic condition. The data obtained will help much for making engineering studies of the gear leading to better understanding and standardisation of the system. The various instruments developed successfully are trawl depth meter for measurement of depth of operation of trawl net, underwater tension meter for the measurement of resistance to motion of the net and otter board collectively and separately, tilt meter for measuring both sideway tilt and fore and aft tilt of otter boards, angle of attack meter for measuring the angle of attack of otter boards, mesh distortion meter for estimating the shapes of meshes of nets and thus their distortions from the desired values, catch telemeter for indication of the catch in the net, net-flow meter for the measurement of flow of water inside the net. All the instrument have been made with rugged design for seaworthy operation. The transducers designed for low impedance and high signal level, are immune to electrical noise enabling the signal transmission much easier with unshielded ordinary two-core cable. The indicating meters on board vessel display the information in analogous meters with provision for feeding to potentiometric recorders for permanent recording and detailed analysis later. All

the instruments working on self contained 9V dry cells with very low power consumption of 30 milliamphere are highly portable rendering them suitable for field operations. For making the data collection further simpler another electronic indicating meter has been developed namely universal marine telemeter for displaying all the informations one by one in a single meter. This has reduced the complications and difficulties of handling several instruments on board the vessel. The instruments indicate the information with an accuracy of $\pm 1\%$ of the respective ranges. Some typical data obtained from some fishing operations on the engineering parameters of the otter trawel are presented.

70. MARINE ENVIRONMENTAL MONITORING SYSTEMS FOR INVESTIGATIONS IN FISHERIES AND ALLIED FIELDS

T. K. SIVADAS

Central Institute of Fisheries Technology, Cochin-682 029

Marine environmental measurements are needed for conducting the investigations effectively in a variety of related fields namely fisheries, oceanography port and harbour management, coastal zone management, offshore mineral and oil prospecting etc. The author reports on the successful implementation of some instrumentation programmes for acquiring marine environmental data such as water current, current direction, salinity, temperature and depth of operation. The modern electronic circuits and design concepts used have rendered the instruments to be highly portable and rugged. The author emphasises the importance of various sensors for making marine instrumentation a success. New types of sensors of noval features have been developed and used in the instruments namely, water meter and salinity-temperature-depth meter. The sensors designed with very low impedance and high level signal outputs have rendered the instruments quite reliable with comparatively simpler electronics. A large scale data acquisition system designed for automatic acquisition of coastal environmental data is reported. The noval features of this sixteen channel data acquisition system are its newly designed sensors suitable for hazardous environment and its noval remote control circuits. The success of this programme has opened up new avenues for automatic wire telemetry measurements especially in marine and other environmental fields.

71. ELECTRONIC INSTRUMENTATION FOR THE FISHERIES

D. SRINIVASAN & ANAND PARTHASARATHY

Naval Physical and Oceanographic Laboratory, Cochin-682 004

The measurement and understanding of ocean parametres has always been complementary to the effective exploitation of fishery resources. With the advent of micro-computer techniques, marine instrumentation relevant to the fishery industry has received a new thrust by way of extremely compact on board systems for echo sounding, bottom profiling, ocean temperature, and salinity measurements as well as the measurement of tides, currents and scattering layers.

This paper reviews the major electronic techniques of marine instrumentation which assist modern fishery enterprises. The paper also describes some recent instrumentation developed at NPOL primarily for naval needs but which can be adopted for use by civilian maritime agencies. These include an ocean going current meter, an expendable bathy thermograph and a small portable search light sonar. Recent efforts in NPOL in the field of micro processor based ocean data acquisition systems are described, as also our experience regarding the limitation of acoustic techniques what are used in fish finding.

72. DESIGN AND FABRICATION OF A TILTING KETTLE FOR FISH PROCESSING INDUSTRIES

P. N. JOSHI

Central Institute of Fisheries Technology, Cochin-682 029

An electrically heated stainless steel jacketed kettle of 80 litre capacity working at a steam pressure of 1.06 kgf/cm^2 (15 psig) has been designed and fabricated for use in fish processing industry for cooking of fish, and prawn. The details of design, construction and operation are described. The equipment which is provided with tilting arrangement and operational controls allows cooking at a constant temperature under hygienic conditions. The cost of the equipment is about Rs. 8000/-. The economics of operation are also presented.

73. DESIGN OF SEMI-COMMERCIAL PLANT FOR THE PRODUCTION OF SHARK LIVER OIL

P. K. CHAKRABORTY

Central Institute of Fisheries Technology, Cochin-682 029

This paper describes the design of a 1000 kg/day capacity shark liver oil plant. Process including refining operation, complete specifications and functions of individual equipment have been described. A process flow sheet and equipment layout have also been indicated.

Session V HANDLING & TRANSPORTATION OF FISH

Date : 25-11-1982
Time : 09.00-11.00
Venue : CIFT Hall No. 1

Chairman : **Dr. A. N. Bose**
Professor of Aquacultural
Engineering,
Indian Institute of Technology,
Kharagpur-721 302

Keynote address : **Dr. Ing. Johny Rorvik**
University of Trondheim
N-7034,
Trondheim—NTH,
Norway

75. HANDLING, PROCESSING AND MARKETING OF ANCHOVIELLA

T. A. MAMMEN & M. D. MENON

Tropical Fisheries Consultancy Services, New Delhi-110 032

The Tropical Fisheries Consultancy Services who studied the question of development of anchoviella fisheries has come to the conclusion that while there is prospect of a ten fold increase in production the bulk of the increased production would go for drying. There is also possibility of increased sale of anchoviella in the fresh, frozen, canned and variously processed forms. However, a major problem is the delicate nature of fish, which makes it necessary to provide chilled sea water storage in fishing vessels as well as on transport vehicles. Dried fish prepared in artificial drier is expected to command a higher price, besides becoming fit for export to sophisticated markets as well as use as a supplementary protein food in the form FPC-B. Speciality products like anchoviella tempura, anchoviella paste etc. are also capable of penetrating into the most sophisticated markets.

76. HANDLING OF TROPICAL FISH IN PERSPECTIVE

R. BALAKRISHNAN NAIR

Central Food Technological Research Institute, Mysore

Recent investigations in India and elsewhere have revealed certain unique characteristics in the spoilage pattern of tropical fish in general and fresh water fish in particular. Their exceptional postmortem behaviour and comparatively longer shelf life, considered significant in handling, have been attributed to basic differences in muscle constituents and associated microflora from temperate and cold water fishes. More recent studies on freezing characteristics and observation on buffer and

autolytic enzyme systems in the muscle, have provided added support to this view. Another consequence of these findings is the necessity to search for more valid methods of quality evaluation of these species. There is also need for a more realistic attitude towards aspects of standards in the tropical context in order to bridge the existing gulf between perspect and practice. An acceptable container for transportation still remains an ideal and available data on resource characteristics, regional needs and surpluses the country's physical profiles relevant to fish trans- portation etc. have not been properly linked up and documented. It is time to debate about the desirability of moving fish over long distances and such problems have to be evaluated rather in terms of overall energy inputs than based on the exigencies of the present situation.

77. HANDLING AND TRANSPORTATION OF FRESH FISH IN INDIA

T. K. GOVINDAN

Central Institute of Fisheries Technology, Cochin-682 029

The research and development activities carried out in India for better handling, transportation and utilization of fresh fish have been reviewed. A major break through in these efforts was made by the launching of an All India Co-ordinated Research Project on Transportation of Fresh Fish by the Indian Council of Agricultural Research. Elaborate field experiments were conducted under the project employing different varieties of fishes available in India, various types of containers and different modes of transport. Quality changes in the fish during transportation studied by employing biochemical, bacteriological anp organoleptic norms have established the technical feasibility of long distance transportation of fresh fish in India. The project has formulated norms for handling and transportation of fish in domestic trade, codified the methods of handling of fish right from the point of harvesting till it reaches the consumer in the domestic market and laid down the requirements for containers for transportation of fresh and frozen fish. The need for imposition of a certain degree of statutory controls obligations regarding maintenance of hygienic conditions of handling and observance of reasonable quality in domestic trade in fresh fish has been pointed out. The urgent necessity of building up of a 'cold chain' in India is emphasised.

78. HANDLING OF HIGH QUALITY FRESH FISH

JOHNNY ROYVIK

*The University of Trondheim, The Norwegian Institute of Technology,
N 7034, Trondheim*

This paper gives the results from large scale investigations in quality and temperature conditions by handling lean and semi-fatty fish in insulated containers. Some more novel methods to handle fish for retail market are also discussed.

Great improvements are possible, especially in the first links of the cold chain when the fish is in the stage of raw materials. It is proved that insulated containers of about 1 ton and the use of chilled seawater (CSW) or chilled fresh water (CFW) are possible methods for establishing more effective handling systems.

Retail of consumer packed fresh fish seems logical because of the similar trend within the meat industry. The open refrigerated cabinets generally used in markets today are, however, a problem because of the great variations in temperature.

79. ON A PURSE SEINE BOAT WITH CHILLED SEA WATER PRESERVATION FACILITY

P. K. SALIAN, G. G. HIREMATH & H. P. C. SHETTY

College of Fisheries, Mangalore-575 002

With a view to improve the quality of purse seine catches, the purse seine boat of the College of Fisheries was provided with a chilled sea water (CSW) fish hold, where the temperature of fish drops down to 0°C within half an hour of catching the fish. This modern method of immediate preservation of fish in chilled sea water has been found to substantially improve the quality of the fish brought to the landing centres. Such fishes maintain their quality even when transported to interior places and distant markets. The provision of CSW fish hold in purse seine boats could eliminate the carrier boat and improve the fishing

efforts, besides improving the quality of fish landed. The main features of the chilled sea water fish hold and the handling techniques of the purse seine catches are described in the paper.

80. PRELIMINARY STUDIES ON UTILITY OF DRY ICE IN LONG DISTANCE TRANSPORTATION OF FROZEN SEAFOODS

A. D. Dholakia, C. N. Khatri, Y. A. Trivedi, R. G. Dabhi & N. D. Chaya

Gujarat Fisheries Aquatic Sciences Research Institute, Port Okha

Though Gujarat produces over 2.4 lakh tonnes of seafoods a major quantity has to be sun dried and/or salted due to inadequate transport by road, rail or sea, in spite of the fact that there is heavy demand of fresh and frozen seafoods in metropolitan areas in Gujarat and elsewhere viz., Ahmedabad, Baroda, Surat, Bombay, Delhi, Calcutta and others. Preliminary studies have been conducted to examine the potential of using dry ice for long distance transportation. The observations seem to be encouraging enough for further extensive and intensive studies. It was observed that a processed frozen product could be transported in insulated van with 12-14 % dry ice up to more than 600 km and could be kept in good condition for about 45 hours.

81. ICED STORAGE CHARACTERISTICS OF PEARL SPOT (*ENTROPLUS SURATENSIS*) CAUGHT FROM COCHIN BACKWATERS

P. K. SURENDRA & K. MAHADEVA IYER

Central Institute of Fisheries Technology, Cochin-682 029

Freshly caught pearl spot from Cochin backwaters were stored in crushed ice in thermocole-insulated ice boxes and their storage characteristics were determined bacteriologically, biochemically and organoleptically. The total aerobic plate count increased from 10^4 /g muscle to 10^9 /g muscle by 21 days of storage. The total volatile basic nitrogen registered gradual increase with storage period, while extractable sarcoplasmic and myofibrillar proteins decreased. Organoleptically the fish

became unacceptable by 10-14 days in ice. The results indicated that pearl spot remained in more or less prime condition in ice for 8-10 days.

82. PRESERVATION OF OIL SARDINE WITH PROPYL PARABEN DIPS

P. K. SURENDRA & K. GOPAKUMAR

Central Institute of Fisheries Technology, Cochin-682 029

Oil sardine was dipped in propyl paraben solutions of 500 p.p.m. and 1000 p.p.m. strength and stored in ordinary crushed ice. The storage characteristics of the fish were determined bacteriologically, chemically and organoleptically. The shelf life of 1000 p.p.m. paraben treated oil sardine improved by 5 days over the untreated control samples. Qualitative studies on the bacterial flora showed that the spoilage of paraben treated oil sardine was caused by a mixed flora consisting the *Pseudomonas*, *Moraxella*, *Acinetobacter*, and *Vibrio* spp. Propyl paraben sensitivity of the residual flora of fish decreased with increase in storage period.

83. ICED STORAGE OF GHOL (*PSEUDOSCIAENA DIACANTHUS*) FILLETS

D. K. GARG & JOSE STEPHEN

Bombay Research Centre of Central Institute of Fisheries Technology, Bombay-400 005

The iced storage characteristics of ghol (*Pseudosciaena diacanthus*) fillets were studied. Fillets weighing 200-250 g having an average thickness of 4 cm were stored, unwrapped and wrapped in polythene sheet. Total nitrogen, non protein nitrogen and sarcoplasmic protein decreased during iced storage. The rate of decrease was more in unwrapped samples than in samples wrapped in polythene. But the increase in total volatile nitrogen was more in wrapped fillets than in unwrapped fillets. Free fatty acids and thiobarbituric acid values increased considerably on the 12th day of iced storage, but there was no difference

between the unwrapped and wrapped fillets. Total bacterial count decreased to a minimum on the 4th day of storage and then increased constantly. On the 10th day of iced storage the texture was soft and sticky. Flavour deterioration was sharp on the 10th day of storage. In both forms of storage, the acceptability sharply declined after 10 days. Between wrapped and unwrapped, wrapped fillets were more acceptable.

84. EFFECT OF SUPER CHILLING ON THE QUALITY OF COD FILLETS

JOSE JOSEPH

Central Institute of Fisheries Technology, Cochin-682 029

A comparative study was made on the effect of super chilling and icing on the quality of cod fish fillets. Triangle test and scoring studies were made to assess the quality. Super chilled fillets were getting higher scores throughout the study except on 14th day of storage. Significant difference at 5% level between the mean score values were noted on 15 days stored samples. The difference was not reflected in the triangle test. A significant difference in triangle test was noted on 9th day while there was no considerable difference in the mean values of scores between the two samples. Both samples stored for 10 days were frozen and kept in the frozen storage for one month and analysed for sensory qualities. There was significant difference both in the mean value of scores and triangle test. A tendency to give middle order scores was noticed among the panel members during the storage studies.

There was not much difference in the amount of TMAN and TVB between the two samples. In the early stages of storage iced sample showed slightly higher values of TMAN and TVB while in the later stage- super chilled samples showed a slightly higher value. There was considerable difference in the cook drip loss between the two samples. Super chilled samples showed a lower cook drip loss. The drip loss increased during storage.

85. STUDIES ON THE ICED STORAGE CHARACTERISTICS OF COMMERCIALIY IMPORTANT FRESH WATER FISHES

J. K. BANDYOPADHYAY, A. K. CHATTOPADHYAY & S. K. BHATTACHARYYA

Burla Research Centre of Central Institute of Fisheries Technology, Burla-768 017

The iced storage characteristics of five commercially important fresh water fishes viz. *Labeo rohita*, *L. calbasu*, *L. gonius*, *Cirrhinus mrigala* and *C. reba* are reported. The interspecies differences in muscle pH and the biochemical parameters viz. moisture, total volatile nitrogen, alpha-amino nitrogen and peroxide value are given. Total bacterial count followed a similar pattern during the iced storage for all the fishes. It is confirmed that in each species the larger fish have longer storage life than smaller ones.

86. PROTEIN AND RELATED CHANGES IN CUTTLE FISH (*SEPIA ACULEATA*) DURING ICED STORAGE

H. M. CHIDANANDA SASTRY & L. N. SRIKAR
College of Fisheries, Mangalore-575 002

The changes in total nitrogen (TN), salt soluble protein (SSP), water soluble proteins (WSP), non-protein nitrogen (NPN) and total free amino acids of cuttle fish (*Sepia aculeata*) preserved in ice at 0°C over a 14 days period of storage was studied. The total nitrogen content decreased from 3.12 to 1.98%, WSP decreased from 19.04 to 10.04% and SSP which constituted about 80.36% of protein in the cuttle fish meat decreased to 61.16% at the end of 14 days of storage in ice. A gradual decrease in the NPN content was also noticed. A considerable increase in total free amino acid content was observed from 1st day to 2nd day of storage. After the second day the free amino acid decreased steadily due to the leaching effect of ice melt water. The change in protein and related parameters of cuttle fish stored in ice are discussed.

87. TRANSPORTATION OF FISH: MATHEMATICAL MODELS FOR THE EXPENDITURE PATTERN

K. KRISHNA RAO & G. R. UNNITHAN

Central Institute of Fisheries Technology, Cochin-682 029

A study on the cost aspects of three types of transportation of fish namely, a) iced fish, b) frozen fish and c) iced fish with re-icing at an intermediate station and with proportions of fish to ice varying from 0.5 to 2.0 were tried for durations of 24 to 48 hours in different seasons. The icing of fish could be cheaper than freezing for short distance transportation. For long distances, considering the comparatively larger quantity of frozen fish that could be packed than iced fish in the same container (because of larger quantity of ice needed for the latter) and comparing with the cost of icing/re-icing of fish as an alternative, the choice of the most economical one for a particular destination poses a problem. The mathematical models developed in respect of the three types of transportation, help in choosing the least expensive one in this context.

Session VI

BIOCHEMISTRY AND BACTERIOLOGY OF FISH
PRESERVATION AND STORAGE

Date : 26-11-1982

Time : 09.00-13.00

Venue : CIFT Hall No. 1

Chairman : **Dr. G. B. Nadkarni**
Head, Biochemistry & Food
Technology Division,
Bhabha Atomic Research Centre
Bombay-400 085

Keynote address : **Dr. T. M. Rudrasetty**
Professor & Head
Department of Fish
Processing Technology
College of Fisheries
Mangalore-575 002

88. FREE AMINO ACIDS AND NUCLEOTIDES AS FLAVOUR COMPONENTS OF FRESHWATER FISH

J. R. RANGASWAMY & S. V. SURYANARAYANA RAO

Central Food Technological Research Institute, Mysore-13

The free amino acid and nucleotide profiles of freshwater fish, namely, mrigal (*Cirrhinus mrigala*), common carp (*Barbus carniaticus*) and cat fish (*Mystus gulio*) were studied. Total nucleotide content was comparable to the data reported for rainbow trout but ATP could not be detected in the above three species as in the case of Indian marine fish ADP and AMP were however detected in appreciable amounts besides traces of several degradation products including hypoxanthine. The other noteworthy feature was the presence of GMP, a potent flavour enhancer. Free amino acid levels were much lower than in marine fish, prominent among them being glutamic acid, histidine, arginine and lysine. Results of the above investigation have been discussed in the light of the earlier findings on the flavour of fish and shell fish.

89. COMPARISON OF THE BIOCHEMISTRY AND BACTERIOLOGY OF TROPICAL AND TEMPERATE WATER FISH DURING PRESERVATION AND PROCESSING

R. G. POULTER, C. A. CURRAN, B. ROWLANDS & J. G. DISNEY

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The processing and storage characteristics of cold and temperate water fish are well established but relatively little is known about tropical species. Recent studies on tropical fish stored under chilled conditions have shown that some species undergo a cold shock contraction and many species have a longer shelf life in ice than would be expected for cold or temperate water species. It has also been found that the proteins of some tropical fish are more stable during processing than the proteins of species from colder waters. This paper discusses these findings and compares the biochemistry and bacteriology of fish from both tropical and colder waters in an attempt to explain these differences.

90. BIOCHEMICAL CHANGES IN TWO SPECIES OF CAT FISH DURING FROZEN STORAGE

KHALANDAR SABI & G. G. HIREMATH

College of Fisheries, Mangalore-575 002

Fillets of *T. caelatus* were texturally unacceptable after four months of storage, whereas fillets of *T. thalassinu* were acceptable both in texture and flavour even after six months of storage at 20°C. The rates of increase of TBA, PV, FFA and protein denaturation were faster in *T. caelatus* compared to *T. thalassinus*. Increase in FFA in both the species is well correlated with concomitant decrease of SSN. Decrease of SSN further correlated with decrease of texture scores.

Fractionation of lipids of *T. thalassinus* showed that the ratio of neutral lipids to phospholipids was 3:2 in the begining and changed to 2:1 after six months' storage at -20°C. The phospholipid content decreased gradually whereas neutral lipids remained constant, indicating that phospholipid fraction is the constituent which breaks down during storage to form free fatty acids.

91. ORGANOCHLORIDE INSECTICIDE RESIDUES IN FISH SAMPLES FROM VELLAR ESTUARY, SOUTH INDIA

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Centre of Advanced Study in Marine Biology,
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The residue concentrations of organochlorine insecticides such as DDT and its metabolites, YBHC (Lindane) and endosulfan have been determined in samples of the fish, *Mugil cephalus*, *Siganus jauas* and *Mystus gulio* collected fortnightly for one year from different locations of the Vellar estuary. The concentration of DDT and its metabolites ranged from 0.6 to 5.6 ug/kg; lindane from 0.36 to 3.2 ug/kg and endosulfan from 0.04 to 1.5 ug/kg on wet weight basis. The DDT metabolites detected were *p*, *p'* DDE and *p*, *p'*-DDD. DDE accounted for most part of the total DDT. Lindane was found nearly as often as DDT, but at lower concentrations. The insecticide concentrations

were found to be in the order of DDT > lindane > endosulfan. The levels of organochlorine insecticides and lipid content of fish were correlated. Increasing residue levels of chlorinated hydrocarbons were found in the order of *M. gulio*, *M. cephalus* and *S. javus*. The residue levels do not seem to be an immediate danger to the fish. None of the sampling locations produced consistently higher residues than the others.

92. CIGUATERA POISONING—A REVIEW

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Ciguatera is the most wide spread and severe form of intoxication which is caused by the consumption of tropical fishes with no prior history of toxicites in fishes. Ciguatera toxicity is associated with some components of fish diet e.g. toxic algae, invertebrate oyster, marine snail or coral reef fishes. The poisoning has been recorded earliest in 1606. This poisoning is combination of symptoms in a disease both with neurological and gastro intestinal, with typical burning sensation of extremities within 6 hours of ingestion of fish. Paraesthesia of legs, tongue, limbs, vomiting and diarrhoea as the common syndroms. Severe neurological syndrome consist of ataxia diminished reflexes, traner, muscular twitching dysphona dysphagia. Clonic tonic convulsions followed with muscular paralysis. There is no antidote to it. Treatment in servere form is carried out symptomatically.

More than 400 species of fishes have been incriminated in intoxication. Besides fishes, oysters, clams may also be involved. Cutbreakes are usually seasonal, Viscera of fishes is more toxic than muscle. The proportion of toxic fishes vary considerably.

Bioassay of toxin is performed by feeding ciguateric fishes to cat, mongoose or by intraperitoneal injection of extract in swiss mice. The toxic fraction can be extracted by chemical chromatographic methods, radio immnue assay and calorimetric assay of ciguatera toxin has been developed. Prophylactic measures have been suggested.

93. THE USE OF PESTICIDES FOR ILLEGAL FISHERIES

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The prob' em of the relative toxicity of lindane and endosulfan to fish as compared to humans is discussed. Trials of the recovery of lindane after experimental poisoning showed that commercially sized tilapia (100-150 grams TW) contained 1-2 p.p.m in the muscle and 4-5 p.p.m in the gills. Controls (not poisoned fish) contained 0.05-0.01 p.p.m. Tilapia fingerlings contained 2-4 p.p.m in the gills, less in the fillet and none in the controls. Endosulfan seems to be slightly less toxic to tilapia than lindane.

94. HEAVY METAL CONCENTRATION IN SOME COMMON EDIBLE FISH SOLD IN THE CITY OF BOMBAY

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64 samples of four species of common fish, sold in Bombay city were analysed by flame atomic absorption technique for heavy metals like zinc, copper, lead, cadmium, iron and nickel. The heavy arsenic was chemically analysed by modified Gutzeit method. Amongst all heavy metals, arsenic concentration was high in all species i.e. more than 2 p.p.m. Only one sample each from Bombay duck, shell fish and pomfret and two samples from prawns were found to contain less than 2 ppm of arsenic. All other heavy metals in all species were found within the tolerable limit. A slightly higher concentration was observed in fish samples from Thana and Chembur market as compared to that of Dadar market. This may be due to the industrial contaminants in that particular area.

95. DISTRIBUTION CHARACTERISTICS OF HEAVY METALS IN CERTAIN FOOD FISHES OFF COCHIN

P. T. LAKSHMANAN

Central Institute of Fisheries Technology, Cochin-682 029

Hg, Cu, Zn, pb, Mn and Cd were analysed in 9 species of fish, 5 species of prawns and a backwater crab. Effect of season on the level of metals and their localisation in the body were studied. Measurements were made using atomic absorption spectro-photometer and mercury analyser in the case of mercury. All the samples except tuna and crab meat exhibited mercury content 100 p.p.b. In tuna it varied from 120-220 p.p.b. and in crab meat the variation was from 160-375 p.p.b. Copper concentration, in general, was found to be low and in most products the level was 5 ppm. Zinc concentration was in the range of 6.5-30 p.p.m. Higher levels of copper and zinc content were found in crab meat and that claw meat contained a highest concentration of than body meat. Lead, manganese and cadmium were found only in copper and zinc traces.

96. UPTAKE AND LOSS OF MERCURY IN THREE BIVALVE MOLLUSCS, NAMELY, *PERNA VIRIDIS* (LINNAEUS) *VELLORITA CYPRINOIDES* VAR. *COCHINENSIS* AND *MERETRIX CASTA* (CHEMNITZ)

P. T. LAKSHMANAN

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&

P. N. KRISHNAN NAMBISAN

Department of Marine Science, University of Cochin

Mercury was taken up from the environmental water by all the bivalve molluscs much above the ambient level. The amount of metal in the tissues of the animals are very much dependent on the concentration of the metal in the medium. Highest concentration factor was obtained for the mussel, *P. viridis* and it decreased with increasing concentration of mercury. Rate of uptake was rather slow in *M. casta*.

Gills of the animals were found to be the major site of mercury accumulation. The tissue levels of mercury declined in these molluscs when they were maintained in a mercury free medium. However, the depuration of mercury seemed to be rather a slow process when compared with rate of uptake. Total purification could not be achieved in any of these mulluses during an experimental period of 20-24 days.

97. THE ROLE OF EXTRACELLULAR PROTEASE FROM A PSEUDOMONAD ON SPOILAGE OF MACKEREL

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Biochemistry & Food Technology Division, Bhabha Atomic Research Centre, Bombay-400 085

Pseudomonas marinoqlutinosa isolated from mackerel (*Rastrelliger kanagurta*) was found to produce appreciable amounts of extracellular protease when grown in nutrient broth or semi-synthetic medium containing yeast extract as nitrogen source. The enzyme was isolated from the culture supernatant by lyophilisation, dialysis and affinity chromatography on bovine serum albumin bound CH-Sepharose. The enzyme degraded several proteins including bovine serum albumin, lysozyme, haemoglobin and cascin, although it was most active against a preparation of structural proteins from mackerel. Optimum temperature for the enzyme action was 50°C and pH range 7 to 9. Influence of the enzyme on the mackerel actomyosin was examined. Incubation of the fish actomyosin with the enzyme at 0-2°C for a period of 4 days caused significant release of tyrosine from the protein. The treatment resulted in loss of about 60% of Mg-dependent ATPase activity of the actomyosin, while Ca-dependent ATPase activity was not affected. The loss of initial texture of the fish muscle could thus be attributed to the breakdown of actomyosin by the protease.

98. NUTRITIVE VALUE OF RED AND WHITE MEAT OF OIL SARDINE (*SARDINELLA LONGICEPS*)

M. K. MUKUNDAN, A. G. RADHAKRISHNAN, M. A. JAMES & M. R. NAIR

Central Institute of Fisheries Technology, Cochin-682 029

Dried red and white meat of oil sardine was fed to albino rats along with protein free basal diet. Simultaneously controls were also run with casein and protein free basal diet. The study was conducted for a period of one month. The results showed that the PER is higher for fish fed animals than casein fed animals. Similarly the enzyme activities of lipase and protease were also high in fish fed animals. The difference between red and white meat in PER and the enzyme activities are also reported.

99. PROPERTIES OF IMMOBILISED LIPASE

M. K. MUKUNDAN, K. GOPAKUMAR & M. R. NAIR

Central Institute of Fisheries Technology, Cochin-682 029

Lipase purified from the hepatopancreas of oil sardine (*Sardinella longiceps*) was immobilised by polymerisation in acrylamide gel, followed by lyophilisation. 75% of the enzyme activity was immobilised by this method. The properties of the immobilised enzyme such as pH and temperature optima and the rate of hydrolysis of various triglycerides are also reported.

100. CHANGES IN MAJOR PROTEIN FRACTIONS OF OIL SARDINE (*SARDINELLA LONGICEPS*) AND MACKEREL (*RASTRELLIGER KANAGURTA*) DURING FROZEN STORAGE

A. G. RADHAKRISHNAN, P. D. ANTONY & M. R. NAIR

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Oil sardine (*Sardinella longiceps*) and mackerel (*Rastrelliger kanagurta*) were frozen stored for 6 months at -18 C. Changes in the protein fractions were followed periodically by protein fractionation with

appropriate buffers. In the case of both oil sardine and mackerel, the myofibrillar fraction showed decrease with rise in the denatured fraction as the storage period increased. In the sarcoplasmic protein fraction, mackerel protein showed definite decrease whereas oil sardine showed a very low decrease in its content. Both oil sardine and mackerel showed a definite increase as far as new protein fractions are concerned with increase in storage period.

101. CHEMICAL COMPOSITION OF SOME FOOD FISHES

A. G. RADHAKRISHNAN, JOSE STEPHEN,
M. K. MUKUNDAN & M. A. JAMES

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Chemical composition of caranx (*Caranx leptolepis*) threadfin bream (*Nemipterus japonicus*), whiting (*Sillago sihane*), murrels (*Ophiocephalus*), carps (*Barbus sarana*) and wallagu (*Wallagu attu*) were studied. Calorific values of these fishes were computed. The amino acid composition revealed that these fishes are well balanced with respect to the essential amino acid make up. They are also rich in minerals like sodium, potassium and calcium.

102. HEAT COAGULATION STUDIES ON MIXED SYSTEMS OF ACTOMYOSIN AND SARCOPLASMIC PROTEIN

A. G. RADHAKRISHNAN, P. D. ANTONY & M. R. NAIR
Central Institute of Fisheries Technology, Cochin-682 029

Actomyosin and sarcoplasmic proteins were prepared from oil sardine (*Sardinella longiceps*), mackerel (*Rastrelliger kanagurta*), mullet (*Mugil parisa*), cat fish (*Tachysurus dussumieri*), tilapia (*Tilapia mossambica*) and poolan (*Eleotris fusca*) by extracting with appropriate buffers. They were heat coagulated individually and also after mixing in various proportions. The ratio of actomyosin to sarcoplasmic protein varied from 0.28 to 1.2 while the ratio of actomyosin to coagulable sarco-

plasmic protein varied from 0.28 to 2.0. On mixing sarcoplasmic protein and actomyosin in various proportions it is observed that when heat coagulated mainly the actomyosin is affected. These observations may have a direct bearing on the gel forming capacity of their respective meats.

103. FATTY ACID COMPOSITIONS OF MUSCLE AND SKIN LIPIDS OF OIL SARDINE

P. G. VISWANATHAN NAIR & M. RAJENDRANATHAN NAIR

Central Institute of Fisheries Technology, Cochin-682 029

Fatty acid compositions of muscle and skin lipids of oil sardine (*Sardinella longiceps*) collected every month for a period of two years are presented in this paper. There were wide variations in the proportions of the various acids of these lipids. Total saturated acids in muscle lipids varied from 35 to 42%, with an average of 38%. Total monounsaturated acids averaged 23.5%, lowest value being 19% and highest, 31%. Proportions of total polyunsaturated acids ranged between 28 and 46% (average, 38%). Similar variations were observed in the case of all major component acids. The pattern was similar in skin lipids also. Skin lipids had a slightly higher level (by about 3%) of total monounsaturated acids and correspondingly lower proportions of polyunsaturated acids.

104. HYPOCHOLESTEROLEMIC EFFECT OF FISH PROTEINS AND FISH OILS IN ALBINO RATS

P. G. VISWANATHAN NAIR, K. DEVADASAN & P. D. ANTONY

Central Institute of Fisheries Technology, Cochin-682 029

Casein or fish protein from *Nemipterus japonicus*, as the main source of protein and groundnut oil or sardine oil as the main source of fat, were used in four different combinations in diet; of four groups of 3 week old albino rats to study their effect on the cholesterol levels in the serum, liver and heart of the animals.

Casein-groundnut oil group (control) had the highest level of serum cholesterol and casein-fish oil group, the lowest. Fish protein-groundnut oil fed animals also showed a significantly lower level of serum cholesterol, suggesting a hypocholesterolemic effect in the case of fish protein also. However, in the case of fish protein-fish oil group, the lowering of cholesterol was not as pronounced as would be expected by a combined hypocholesterolemic effect of fish oil and fish protein. The pattern of cholesterol levels was the same in liver and heart. Lowering of serum cholesterol did not result in an increase in liver cholesterol levels. Significance of these findings are discussed.

105. CHANGES IN NICOTINIC ACID CONTENT DURING CHILLED STORAGE OF FISHES AND SHELL FISHES

K. AMMU, K. DEVADASAN & P. D. ANTONY

Central Institute of Fisheries Technology, Cochin-682 029

Nicotinic acid content of oil sardine (*Sardinella longiceps*), white tailed pink perch (*Nemipterus japonicus*) and two species of prawns (*Penaeus indicus* and *Metapenaeus monoceros*), and its loss during storage in ice are reported. At the end of the storage period of two weeks, retention of nicotinic acid was 34% of the original value in sardine, 30% in prawns (both species) and 49% in white tailed pink perch. The loss is mainly attributed to leaching by ice melt water. A study of the seasonal changes in nicotinic acid content of oil sardine showed a decreasing trend with increasing fat content.

106. INFLUENCE OF THE FAT CONTENT OF RAW MATERIAL USED FOR THE MANUFACTURE OF FISH PROTEIN CONCENTRATES, ON THE NUTRITIONAL QUALITY OF THE PROTEIN

K. DEVADASAN, A. T. REPPEN & JOHANNES OPSTVEDT

*Norwegian Herring Oil and Meal Industry's Research Institute,
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Two samples of functional fish protein concentrates (FFPC) were prepared from fillets of the lean fish, Saithe, one using the fillets as such

and another in which case, calculated amount of Saithe liver oil was added to the muscle slurry during the preparation of FFPC, to give a fat content comparable to the fatty fish capelin. Both FFPC samples were subsequently solvent extracted to give comparable low fat content and these samples were used as sole sources of protein in the diets of two groups of one week old calves. Comparison of the digestibility and protein utilization did not show any significant difference between the two samples of protein. The results do not support the theory that differences in the fat content of the fishes used for FFPC manufacture can cause corresponding differences in the nutritional quality of their proteins.

107. RATE OF ABOMASSUM EMPTYING IN KIDS FED ON FISH PROTEINS SUBJECTED TO HEAT TREATMENT UNDER DIFFERENT CONDITIONS

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7 groups of kids were fed on isonitrogenous diets identical in all respects, except in the nature of the protein. Proteins in all test diets were derived from fish muscle and subjected to heat treatment under different conditions. Control group had skim milk as the sole source of protein. 5 test groups had their proteins from muscle of the loan fish, blue whiting, heat processed under different conditions. The seventh group had a spray dried and solvent extracted functional fish protein concentrate prepared from the fatty fish, caplin, as the sole source of protein. The effect of the mode and extent of thermal denaturation of fish protein on the rate of abomassum emptying in kids was studied using these diets with a view to check the possibility that increased thermal denaturation causes lesser coagulation of the protein in stomach, resulting in reduced digestibility. Results, however, indicate that in kids the extent of thermal denaturation of the protein in diet cannot be directly correlated to the rate of abomassum emptying. Results are discussed in the light of earlier reported differences in protein digestibility between these diets in calves.

108. INFLUENCE OF HABITAT ON THE FATTY ACID COMPOSITION OF TILAPIA (*TILAPIA MOSSAMBICA*)

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Lipids were extracted from the body and viscera of tilapia of the same age group from fresh water and brackish water natural habitats separately and the fatty acid composition was determined by gas chromatography. Significant difference was observed in the fatty acid composition of tilapia from brackish water and fresh water habitats, the pronounced difference being between the viscera and body lipids. Saturated, monosaturated and polysaturated fatty acids showed differences in the total amounts of these acids as well as individual fatty acids. In polyunsaturated fatty acids, 22:6 W 3 acid was the major acid in the body fat of tilapia of brackish water origin and linoleic acid (18:2 W 6) was the major acid in the body fat of freshwater tilapia. In the freshwater tilapia body fat 20:4 W 6 20:5 W 3 and in brackish water tilapia body fat 20:5 W3 20:4W6. It is seen that the fatty acid composition of tilapia from brackish water was similar to that of a true marine fish.

109. INVOLVEMENT OF HYDROLYTIC ENZYMES IN THE SPOILAGE OF BOMBAY DUCK (*HARPODON NEHEREUS*)

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The involvement of lysosomal hydrolases in the skeletal muscle and drip of Bombay duck in the spoilage of fish was investigated. Experiments carried out with β -glucuronidase as the system indicated a progressive increase in the release of this enzyme, from the muscle to the drip, along with enhancement in the accumulation of E ²⁶⁰ and E ²⁸⁰ absorbing compounds during the storage of Bombay duck fillets at 0°C. The enzyme was purified to homogeneity with a recovery of 20%. The properties of the purified β -glucuronidase showed that this was inhibited by sodium tripolyphosphate which could be used as an effective preservative to prevent autolytic spoilage during the extended period of storage.

110. CHARACTERIZATION OF PROTEOLYTIC BACTERIA ISOLATED FROM *PENAEUS INDICUS* AND *MUGIL CEPHALUS*

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The present investigation was undertaken with a prime objective to study the proteolytic bacteria and their activity in fresh and frozen (minced meat) samples of the prawn *Penaeus indicus* and the mullet *Mugil cephalus*. Effects of storage on the bacterial flora of frozen samples were also observed. A comparative study on the standard plate count and proteolytic population was also dealt with.

A total of 108 samples isolated from *P. indicus* and *M. cephalus* were bacteriologically analysed employing agar plate assay technique with modified "Fraziers Gelatin Agar medium." After incubation for 3-5 days at 30°C, colonies developed on the plates were enumerated and the representative organisms were then isolated. 234 strains were isolated and identified and the selected strains were then subjected to further studies, like tolerance to various temperatures, salinities and utilization of selected nutrients. The results obtained have been documented in this paper.

111. QUALITATIVE AND QUANTITATIVE STUDIES ON BACTERIAL FLORA OF SOME COMMON EDIBLE SEAFOODS AT RETAIL LEVEL IN BOMBAY

J. B. KHOT, A. T. SHERIKAR, A. M. NADGAUDA & S. M. AJINKYA

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166 samples of different types of fishes collected from various retail markets in Bombay were analysed for their microbial load. 417 bacterial isolates were obtained from these fishes. The organisms were divided into pathogenic type and spoilage type. The total number of isolates

for pathogenic types were 241 and the highest number amongst them were of *E. coli* ie. 43 (17.08%). Food poisoning pathogenic organisms such as *Salmonella*, *Staphylococcus aureus*, *Clostridium perfringens* were encountered in this study. The total number of isolates for spoilage type were 176, and among this group 76 (43.18%) isolates were of *Micrococcus luteus*.

112. MICROFLORA OF THE POND CULTURED MILK FISH *CHANOS CHANOS* (FORSKAL)

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Microflora associated with the pond cultured milk fish, *Chanos chanos* was investigated. Qualitative and quantitative studies were made on the bacteria present on the skin, gill and gut of the fish. Of the three microenvironments gut was found to harbour maximum number of bacteria. The microflora increased in the following order: gut>gill>skin.

In the alimentary tract high bacterial load was observed in the hindgut region. Luminous microbiota were also encountered in the present study. They appeared within a short period of incubation. Some of the luminous isolates were found to lose their property after repeated subculture. Taxonomic analysis of isolates was done upto generic level in the case of heterotrophs and species level in the case of luminous microbes. The commonly encountered genera were *Vibrio*, *Pseudomonas*, *Alcaligenes* and *Bacillus*. *Vibrio harveyi* and *V. fischeri* were the two luminous species identified. Of the two luminous species found, *V. harveyi* was the predominant. Relationship between bacterial population and environmental parameters and the significance of the present study in fish nutrition and pathology are also discussed.

113. LUMINOUS MICROFLORA OF MARINE FISH—A CURRENT REVIEW

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This review deals with the luminous microflora associated with skin, gill and alimentary tract of marine fish. Methods of screening, media employed for culture, incubation period, incubation temperature, enumeration and maintenance of these microbes are discussed. Taxonomic status of these microbiota is presented in the light of recent developments. Diagnostic traits for the identification of these microbes are provided. The luminous prokaryotes harboured in these micro-environments falls under two genera, *Photobacterium* and *Vibrio* comprising four species, namely *P. phosphoreum*, *P. leiognathi*, *V. harveyi* and *V. fischeri*. Factors controlling the luminous bacterial population are dealt with. Propagation, proliferation and cycling of these spectacular microbes between the fish and the surrounding milieu are discussed. Role of these microflora in the nutrition and spoilage of fish is also incorporated.

114. SALMONELLA CONTAMINATION IN FRESHLY CAUGHT PRAWNS

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Occurrence of *Salmonella* from various body parts of freshly caught prawns (*Penaeus monodon*) from Porto Novo landing centre is reported. Qualitative study revealed that *Salmonella* was found in all the body parts of the shrimps, except that of the gut region from where no suspected colonies were isolated. Among the body parts, the maximum recovery of *Salmonella* was from the head region.

115. ON THE ISOLATION OF *Salmonella alachua*,
Salmonella muENCHEN AND *Salmonella ESTABOURNE*
FROM FRESH FISH

T. S. GOPALAKRISHNA IYER

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The isolation of three serotypes of *Salmonella*, namely, *S. alachua*, *S. muENCHEN* and *S. eastbourne* from fresh fish has been reported. Apparently, there is no previous report on the isolation of these three serotypes from fish in India. Further, *S. eastbourne* is a rare serotype in this country. Only five strains of this serotype have been reported previously covering a period of 24 years.

116. SURVIVAL OF *Salmonella* IN SHRIMP
AND FROG LEGS

M. ARUL JAMES, T. S. G. IYER & C. C. PANDURANGA RAO

Central Institute of Fisheries Technology, Cochin-682 029

Ten serotypes of *Salmonella* commonly isolated from sea foods, were taken for study of survival in refrigerated and frozen temperature storage and in different pH values. *Salmonella* serotypes were inoculated artificially in two concentrations (low 2×10^2 /g and higher 2×10^5 /g populations) in shrimp, shrimp homogenates, frog legs and frog homogenates. All the serotypes *Salmonella* survived during refrigerated storage (2 to 5°C). Duration of survival was proportional to the initial concentration of inoculation. Heavily inoculated samples showed the presence of *Salmonella* up to five months in the muscle portions of prawns and frog legs, while survival in respective homogenates were up to three months. Lower populations (5×10^2 /g) of *Salmonella* serotypes were destroyed at 60°C, by one minute heating of the homogenates. With larger populations (2×10^5 /g), *S. anatum*, *S. cubana*, *S. enteritidis*, *S. senftenberg* survived at 60°C by one minute heating. Above 80°C none of the serotypes of *Salmonella* survived by five minutes heating. All the sero types tested were sensitive to pH value below 5.0 and 8.0

117. INCIDENCE AND GROWTH OF COAGULASE POSITIVE *STAPHYLOCOCCUS* IN COOKED, PICKED AND FROZEN CRAB MEAT

S. SANJEEV, M. ARUL JAMES & K. MAHADEVA IYER

Central Institute of Fisheries Technology, Cochin-682 029

50 samples of cooked picked and frozen crab meat meant for domestic consumption collected from local cold stores of Cochin were quantitatively examined for the presence of *Staphylococcus aureus* by direct plating on Baird Parker Agar (HI-Media). Periodical sampling revealed a high incidence of the organism in all the samples tested. The load ranged from 10^3 to 10^5 g, which apparently exceed the standard recommended for cooked picked crab meat by "International Commission on Microbiological Specification" for fish and fish products. Cooked picked and frozen crab meat is subjected to contamination during hand picking and handling. The proliferation of the organism has been observed due to the lack of icing or refrigeration during handling and transport of the meat to the cold stores. Swab samples from the hands of the personal handling the raw material were also plated to isolate *Staphylococci* strains whose characteristics were determined and compared with the other isolates. Studies on the growth pattern of *Staphylococci* in crab meat at room temperature and at iced condition were studied to find out the effect of icing during handling and transportation.

118. SURVIVAL OF *VIBRIO PARAHAEMOLYTICUS* IN FRESH AND PROCESSED SEA FOODS

M. PRABHA SAXENA & S. B. KULSHRESTHA

Division of Veterinary Public Health, Indian Veterinary Research Institute, Izatnagar-243 122

Vibrio parahaemolyticus, the marine halophilic bacterium often present in coastal waters and sediments which contaminate fish, shellfish and other sea foods. This pathogen has been identified as one of the important food poisoning agent through consumption of fish and shellfish, particularly when eaten semi-processed or raw. Improved hygienic techniques have been employed for reducing the multiplication level of this pathogen.

Presence of sodium chloride was protective to this organisms. Lower temperatures were sensitive to *Vibrio parahaemolyticus* cells. Refrigerated temperature was more injurious than frozen storage. Injured *V. parahaemolyticus* cells were present in commercial sea foods under normal condition of handling. *V. parahaemolyticus* could survive at 4°C for three weeks and upto 130 days if held at -15 to -30°C in oysters, but in fish fillets it could survive upto 60 days at -15 to -30°C temperatures.

Studies conducted for the survival of *V. parahaemolyticus* in raw and processed crab meat and fish meat indicated a rapid decrease of viability, depending upon the duration of storage, temperature, strain, pH, sodium chloride concentration and technique of enumeration. Direct plating for enumeration was not satisfactory for low level of this pathogen in frozen sea foods. Several enrichment medium have been tested for the enumeration of *Vibrio parahaemolyticus* of chilled and frozen sea foods. Low counts of *V. parahaemolyticus* were observed in irradiated if maintained at refrigerated temperatures.

119. SURVIVAL OF *VIBRIO PARAHAEOMOLYTICUS* IN PRAWNS

I. KARUNASAGAR, S. KRISHNAKUMAR & N. V. HALINGE

College of Fisheries, Mangalore-575 002

The paper describes the results of studies on the survival of *Vibrio parahaemolyticus* in prawns preserved in ice and in chilled sea water (CSW). Freshly caught prawns were contaminated on board with a low initial number of *V. parahaemolyticus* (100-1000 cells/g). These prawns were immediately iced or put in CSW and preserved at temperature 10°C for about a week and *V. parahaemolyticus* counts were performed every 48 h. In CSW, two Kanagawa positive strains Ty 17 and Ty 35 and a Kanagawa negative strain, Ty 36 appeared to show ten fold increase in population upto the 4th day, after which the number started declining to $< 1.0 \times 10^2$ in all cases except Ty 75. In iced samples, Ty 17 with an initial load of 10^3 /g declined in number by the 4th day, but Ty 36 strain showed an initial decline followed by an increase by the 6th day. Ty 81 & Ty 20 multiplied thousand fold by 6th day but the numbers could not be maintained upto the 6th day in the latter case.

120. OCCURRENCE OF VIBRIO DURING FISH SPOILAGE

M. CHANDRASEKARAN, P. LAKSHMANAPERUMALSAMY &

D. CHANDRAMOHAN

Department of Marine Sciences, University of Cochin, Cochin-682 016

Bacteriological analyses of raw unprocessed prawn, *Penaeus indicus*, stored under three different temperatures ($28 \pm 2^\circ\text{C}$, 4°C and -15°C), at various intervals, was carried out. Species of *Vibrio*, *Pseudomonas*, *Acinetobacter*, *Micrococcii*, *Bacillus* and *Corynebacterium* were isolated. Of all the genera, *Vibrio* sp. was found abundant and dominated other spoilers at room temperature. Also, it showed dominance at few instance at 4°C and -15°C . Isolates were confirmed as spoilers based on the spoilage potential test, production of spoilage odour from homogenate and proteolytic activity. Occurrence of *Vibrio* sp. in completely spoiled prawns, its dominance over *Pseudomonas* sp. and *Acinetobacter* sp. and its spoilage potential, observed in the present investigation are discussed, highlighting the role of *Vibrio* sp. in the spoilage of prawns.

121. SPOILAGE POTENTIAL OF MARINE BACTERIA

P. K. SURENDRAN & K. GOPAKUMAR

Central Institute of Fisheries Technology, Cochin-682 029

Spoilage potential of selected bacterial cultures isolated from tropical fish and prawn was studied using sterile fish muscle blocks and sterile press fish muscle juice at three different temperatures, namely $28^\circ \pm 2^\circ\text{C}$, $8^\circ \pm 1^\circ\text{C}$ and $1^\circ \pm 1^\circ\text{C}$. The selected cultures included *Pseudomonas* spp; *Vibrio* spp; *Moraxella* spp; *Acinetobacter* spp; *Flavobacteria/Cytophaga* spp; *Micrococcus* spp; *Arthrobacter* spp. and *Alcaligenes* spp. At $28^\circ \pm 2^\circ\text{C}$, most of the cultures were capable of soilage of fish muscle. At $8^\circ \pm 1^\circ\text{C}$, nearly 25–50% of the *Pseudomonas*, *Vibrio*, *Moraxella* and *Acinetobacter* strains showed spoilage capability, but none of the *Micrococcus*, *Flavobacteria/Cytophaga*, *Arthrobacter* and *Alcaligenes* spp. could cause spoilage. At $1^\circ \pm 1^\circ\text{C}$, majority of the *Pseudomonas* group I, II and III strains were spoilers, while less than 25% of *Pseudomonas* group I, *Vibrio*, *Moraxella* and *Acinetobacter* strains and none of *Flavobacteria/Cytophaga*, *Micrococcus*, *Arthrobacter* and *Alcaligenes* were capable of spoilage.

Session VII FISH PROCESSING

Date : 25-11-1982
Time : 11.15-13.15
Venue : CIFT Hall No. 1

Chairman : **Shri S. N. Rao**
Director,
Marine Products Export
Development Authority,
Cochin-682 016

Keynote address : **Dr. J. Disney**
Head, Animal Products &
Food Department,
Tropical Products Institute,
London

122. EFFECT OF PROCESSING FACTORS ON THE BIOLOGICAL AVAILABILITY OF AMINO ACIDS IN FISH PROTEINS

R. BALAKRISHNAN NAIR

Central Food Technological Research Institute, Mysore-13

Studies were carried out to follow the physicochemical changes occurring in fish protein due to processing variables and storage in order to determine (i) changes in *in vitro* digestibility and (ii) inactivation of amino acid by destruction of vulnerable groups or inactivation by complex formation. Apart from chemical, chromatographic and enzymatic methods, the biological availability was determined using the organism, *Streptococcus zymogenus* in *in-tact* protein. Wherever required studies on model systems were also carried out. It was observed that factors like heat, presence of reactive components, especially sugars and oxidizing lipids, and storage affected the availability of amino acids to varying degrees. These results agreed with observations on changes in the nutritive value of processed fish proteins evaluated by animal feeding experiments.

123. CRAB MEAT AND ITS UTILISATION

C. K. RADHAKRISHNAN & C. T. SAMUEL

*Department of Industrial Fisheries, University of Cochin,
Cochin-682 016*

Edible crabs, namely *Scylla serrata*, *Portunus pelagicus* have been collected during pre new moon, new moon, post new moon, pre full

moon, full moon and post full moon periods in order to study the reported lunar impact on the meat content in crabs. The study revealed no season bound quality loss though meat content was found to vary according to the moulting cycle. Food crabs were arbitrarily graded based on their meat content. Hygienically prepared crab meat was found to be unaffected in quality during frozen storage upto three months. Selection of crab, meat separation techniques, processing etc. are discussed.

124. LIQUID NITROGEN IN IQF FOOD TECHNOLOGY

K. VENUGOPAL

West Coast Industrial Gases Ltd., Shipyard Complex, Cochin-682 015
&

D. DAMODARAN NAMBOODIRY

Kerala Agricultural University, College of Fisheries, Panangad

Individually quick frozen products occupy a prominent position in the wide region of frozen items in the international market in terms of quality, acceptability and premium price. Overall picture of exports from India also shows an increasing trend in this line. But lack of commercially viable low cost designs of freezing systems and limited popularised knowledge on liquid nitrogen cryogenics remain as major constraints for boosting up liquid nitrogen based IQF products. In view of the large number of industrial oxygen units in the country and their potentials for recovering by-product nitrogen as well as the increasing demand in international market for liquid nitrogen based IQF products, there is a vast scope for developing this branch of technology.

125. FROZEN STORAGE CHARACTERISTICS OF SHARK (SCOLIODON LATICAUDUS)

A. C. JOSEPH & K. K. SOLANKI

*Veraval Research Centre of Central Institute of Fisheries Technology,
Veraval-362 265*

Frozen storage characteristics of gutted and beheaded shark (*Scoliodon lat caudus*) individually packed in polythene bag in skinless and

skin on forms were studied for 28 weeks. The biochemical, bacteriological and organoleptic changes in the frozen samples during cold storage at -18°C have been followed systematically. No significant difference has been noted between the two forms of samples in their biochemical characteristics during the period of storage. However the overall quality and storage life of skinless samples were better than those of skin on samples except for initial bacterial counts which were higher in the skinless samples compared to skin on samples.

126. FROZEN STORAGE STUDIES OF RAWAS (*ELEUTHERONEMA TETRADACTYLUS*)

D. K. GARG & JOSE STEPHEN

*Bombay Research Centre of Central Institute of Fisheries
Technology, Bombay-400 005*

The frozen storage characteristics of whole rawas at -18°C were studied. During frozen storage moisture, total nitrogen, non protein nitrogen and alpha amino nitrogen did not undergo significant changes. Sarcoplasmic protein nitrogen decreased to about 22.80 percent from the original 31.0 percent of fresh fish, towards the end of 24 weeks of storage. Total volatile nitrogen registered an increase during storage. Free fatty acids and thiobarbituric acid value also increased during frozen storage. Total plate count decreased considerably during the first 4 weeks of storage and thereafter it did not alter appreciably. Deterioration in texture and flavour became noticeable after 20 weeks of frozen storage. The fish was acceptable upto a period of 20 weeks.

127. UTILIZATION OF FROZEN STORED OIL SARDINE FOR CANNING

CHINNAMMA GEORGE, P. K. VIJAYAN & P. A. PERIGREEN
Central Institute of Fisheries Technology, Cochin-682 029

The suitability of frozen stored oil sardine (*Sardinella longiceps*) for canning has been studied. Fresh and iced oil sardine belonging to different seasons were frozen as glazed blocks, stored at -23°C and used

for canning after definite intervals. The seasonal variation in chemical composition, initial quality and preprocess iced storage of oil sardine influenced the frozen storage characteristics and the quality of the canned product. The fresh frozen sardines were found to be suitable for canning upto 10-24 weeks depending upon the season and initial quality. Icing for 24 hours reduced the frozen shelf-life suitable for canning to 7-18 weeks. The major limiting factors affecting the quality of fresh/iced frozen and canned sardine are developement of toughness, rancidity and peeling of the skin.

128. EXPERIMENTS ON THE CANNING OF MARLIN

G. E. SAMUEL, C. J. Jos & M. K. RAJAN

Integrated Fisheries Project, Cochin-682 016

Marlin (*Makaria* sp.) ranging from 50 to 180 kg were landed by the long-line vessels of the Government of India operating from Cochin Base. As a part of utilisation of marlin, some experiments were conducted in the Integrated Fisheries Project, Cochin and one of the methods evolved was the canning of marlin fillets in oil. Easy open type (ring pull type) quarter dingly aluminum cans were used for the experiment. The paper deals with the cost of production of canned marlin fillets and marlin chuncks. The products has been released into the market recently for the purpose of studying the consumer reaction and market potential.

129. CANNING MACKEREL (*RASTRELLIGER KANAGURTA*) AS FILLETS IN OIL

P. K. VIJAYAN & K. K. BALACHANDRAN

Central Institute of Fisheries Technology, Cochin-682 029

A process of canning mackerel (*Rastrelliger kanagurta*) as skinless and boneless fillets in oil is described. The dressed mackerel is first cold blanched in a solution containing 15% sodium choloride and 1% citric acid for 15 minutes. The brined fish is then cooked in steam at a pressure of 0.35 kg/sq. cm for 30 minutes. The fish after cooling to room temprature under an air blast is manually skinned and stored overnight in a cold room. The fish is subsequently split into two halves parallel to the bone frame and the two pieces put together and packed

in plain quarter dingly cans. It is then filled with hot refined oil, exhausted in saturated steam, seamed and heat processed in steam of 0.7 kg/sq.cm pressure for 45 minutes. Compared to other methods of skin peeling this method is simple and can be advantageously adopted.

130. CANNING OF SMOKED OYSTERS

G. E. SAMUEL, C. J. Jos & R. SATHIARAJAN

Intergrated Fisheries Project, Cochin-682 016

Edible oysters of the species *Crassostrea madrasensis* were farmed at the oyster farm of Central Marine Fisheries Research Institute, Tuticorin. As a part of utilisation and marketing of the edible oyster, experiments were carried out partly at Tuticorin for freezing oysters and partly at Integrated Fisheries Project, Cochin on canning of oysters. The frozen materials from Tuticorin was transported by insulated van to Cochin. For canning, oysters were packed in two different ways ie oyster in brine and smoked oyster in oil. The paper deals with the cost of production and market response studies

131. ECONOMICAL USE OF COAL DUST FOR FISH DRYING

C. P. ANAND

National Institute of Oceanography, Dona Paula, Goa-403 004

Instead of applying common salt alone, its mixture with charcoal powder in 2:1 proportion for quick drying of fish was studied and reported earlier by the author. The reported technique could reduce by 25% the 'Half Loss Period' (HLP) i.e. time required to reduce the total moisture present in the fresh fish by half. The observations drawn were based on laboratory experiments using infra-red radiation as the heat energy source. In order to confirm the earlier results in the field conditions, similar studies using fine coal dust (a reject from the wood charcoal) admixed with common salt were carried out in the open sun as well as the cabinet-type solar dryer. Invariably, the reduction in HLP values were found to be higher than 50%. Regarding the removal of charcoal from the dried fish, on an average 95% of it could be dusted off easily while 2.5% stripped off on soaking in water, a practice normally followed prior to cooking of all dried stuff. The remaining 2.5% stays mostly in the eye sockets, fin rays and over the sacles.

132. REMOVAL OF FUNGUS AND PREVENTION OF ITS REINFESTATION IN STORED DRY SALTED FISH

T. S. UNNIKRISHNAN NAIR, N. KALAIMANI, V. MURALEEDHARAN & K. GEORGE JOSEPH

Calicut Research Centre of Central Institute of Fisheries Technology, Calicut-673 005

Fungi infestation of dry cured fish during storage is a serious problem faced by dry fish traders. Simple techniques were tried to keep the infested fish free of fungus for a reasonable period. These included (a) washing in water and then drying (b) washing, dipping in saturated brine and then drying (c) washing, dipping in saturated brine containing 1% of sodium propionate and then drying (d) washing and drying followed by smearing a mixture of refined salt and sodium propionate on to the dried fish. The last method gave the best results and the product was found to keep for a period of 6 months.

133. PRESERVATION OF MUSSEL MEAT BY DRYING

T. S. UNNIKRISHNAN NAIR, V. MURALEEDHARAN & K. GEORGE JOSEPH

Calicut Research Centre of Central Institute of Fisheries Technology, Calicut-673 005

The paper describes a simple and cheap process for the preservation of mussel meat by drying. The method involves blanching the mussel meat shucked from purified live mussels, in 5% boiling brine for 5 minutes followed by drying to a moisture level of 10-15%. The product stored in glass bottles or polythene bags suitably sealed, has a storage life of about six months after which the organoleptic qualities begin to deteriorate. No preservative is used at any stage of processing. The yield of the product is approximately 20%. The major type of spoilage during storage is brown discolouration. Spoilage due to insect infestation is also common unless packed properly.

134. IMPROVED DRIED PRODUCT ON BLANCHING OF GUDUSIA CHAPRA PRIOR TO SUN DRYING

**S. K. BHATTACHARYYA, J. K. BANDYOPADHYAY &
A. K. CHATTOPADHYAY**

*Burla Research Centre of Central Institute of Fisheries
Technology, Burla-768 017*

Better sun dried products of *Gudusia chapra* were obtained by blanching in 7% brine for one minute prior to drying. The product had an enhanced storage life of 7 months compared to 15 to 35 days in the case of conventional market products. The results of a comparative study on the changes in biochemical parameters during storage of the improved product and the conventional product at room temperature are reported.

135. PRODUCTION OF QUICK SALTED FISH CAKES

S. DURAIRAJ & P. PITCHAIAH

*Fisheries Technological Station, Tuticorin, Department of Fisheries,
Tamil Nadu*

Quick salted *Lethrinus* cake (sea bream) could be prepared by grinding the fish with simultaneous addition of salt in different proportions pressing the ground salted mass and sun drying the cakes. The percentages of salt required for the preparation of quick salted *Lethrinus* cake may be anything from 50% to 75% depending on the protein level required (20 to 30%) in the final product. The total plate count and halophilic count of the freshly prepared products were very low. (1000 per gram and 200 per gram respectively).

The entire salting process is completed within one hour due to the intimate contact of the flesh with the crushed salt, during grinding. The moisture content of the quick salted cake before drying was 28-30%. Further sun drying for a few hours made the product stable against microbial attack with high salt content and low water content.

Complete processing data of the quick salted *Lethrinus* cakes prepared with varying salt:fish ratio are presented.

136. ANTIOXIDANT EFFECT OF BETEL LEAF EXTRACT ON DRY-CURED FISH

N. KALAIMANI, V. MURALEEDHARAN, K. GEORGE JOSEPH &
T. S. UNNIKRISHNAN NAIR

*Calicut Research Centre of Central Institute of Fisheries Technology,
Calicut-673 005*

The effect of betel leaf extract on control of autoxidation of fat in dry fish has been studied. Oil sardines have been selected for experiments since they contain very high amount of fat. The treatments were given with 5% (w/v) betel leaf extract in water, at the stages as follows: a) dipped, salted and dried b) salted, dipped and dried c) partially dried, dipped and dried and d) fully dried, dipped and dried. FFA, PV and TVN values of the samples were determined periodically to assess the keeping quality and autoxidation. The sample prepared by dipping the fish in the extract immediately after salting and then drying as usual was found to have better keeping qualities and lesser rancidity.

137. FURTHER STEPS TO IMPROVE AND ECONOMISE THE USE OF PROPIONATES IN THE PRESERVATION OF CURED FISH

A. P. VALSAN

*Bombay Research Centre of Central Institute of Fisheries Technology,
Bombay-400 005*

The paper describes the development of a new, cheap and indigenously available food additive to effectively substitute the imported sodium propionate, in the preservation of cured fish. The substitute chemical is calcium propionate which is not only economical but is also found to be more effective. Three different methods of applying the preservative have been described and their relative merits supported by analytical data are discussed. By this technique it is possible to control most of the spoilage factors in cured fish, namely, fucus attack, "red" attack and general deteriorations and rancidity in the case of fatty fishes. The shelf-life of dry cured products could be extended from its normal 4 to 8 weeks to over 52 weeks. In the case of wet cured products the normal shelf-life of 2 weeks could be extended upto 16 weeks. The cost of treatment is also discussed.

138. SUN DRYING OF CURED FISH IN A POLYTHENE TENT DRIER

N. V. SRIPATHY & M. BALASARASWATHI

CFTRI Fish Technology Experiment Station, Mangalore

The performance of polythene tent drier designed by Dr. P. E. Doe for solar drying of fish has been tested. The tent gives an air temperature inside it of just above 50°C as compared with an ambient air temperature of about 30°C in the shade. Drying rates for salted silver belly *Selar kalla* (a carangid), oil sardine, sole, ribbon fish and cat fish have been obtained. The advantage derived by drying salted fish in the polythene tent instead of in the open is only marginal in terms of drying rate or the total duration of drying. The main disadvantage is the restriction of scope for turning over the fish during drying. The fish dried in the tents tend to become brittle.

139. A NEW METHOD FOR UTILIZATION OF OIL SARDINE FOR HUMAN CONSUMPTION

G. G. HIREMATH, N. S. SUDHAKAR & H. P. C. SHETTY

College of Fisheries, Mangalore-575 001

A new simple method for preservation of oil sardine for human consumption has been worked out. The fish was cured with salt and pressed in a screw press to remove expressible moisture. The pressed blocks were stored at ambient temperature and also at chilled room temperature of 0–5°C after packing in polythene-lined paper bags. They were periodically assessed for quality. The pressed fish remained in acceptable condition up to 3 weeks at ambient temperature and for more than 2 months at chilled room temperature.

140. CONTROL OF INSECT INFESTATION IN DRY BOMBAY DUCK

A. P. VALSAN

*Bombay Research Centre of Central Institute of Fisheries Technology,
Bombay-400 005*

The success achieved by subjecting Bombay Duck to thermal treatment is presented in this paper. In this technique dry Bombay Duck is kept in a chamber at 125°C for 15 minutes. It is then cooled and immediately packed without giving chance for further infestation. The high temperature annihilate all the initial load of insect, their eggs or larvae and keeps the product insect free for over one year. The process does not affect the quality in hard dried products.

141. REDUCTION OF LOSSES IN CURED FISH PRODUCTS THROUGH IMPROVED CONTROL OF THE PROCESS

C. D. WOOD, C. A. CURRAN, R. G. POULTER & P. E. DOE
*Tropical Products Institute, 56/62 Gray's Inn Road, London,
WCIX 8LU, United Kingdom*

The relationship between processing and fragmentation in cured fish have been investigated and ways of decreasing losses by improved control of the process identified. It was shown that cooked fish had an increasing tendency to fragment as the moisture content was reduced below 30%. Above this moisture level products appear to be more cohesive under the experimental conditions used. Uncooked fish showed little tendency to fragment even at low (11%) moisture contents. Brining had little effect on fragmentation of products which were dried to the same degree as unbrined ones. Losses from fragmentation may be reduced by using lower smoking temperatures or by maintaining relatively high moisture contents. The microbial stability of cured fish is dependent upon its water activity. A formula by which water activity can be calculated simply from the moisture and salt content of the cured products and then used to make predictions of the storage life is presented. Using this system, it is possible to derive values for the minimum rate of drying and final salt and water contents to ensure spoilage is prevented. This improved control of the process will allow losses to be reduced.

142. DEVELOPMENT OF FLEXIBLE PACKAGING FOR MUSSEL PICKLE IN OIL

T. K. SRINIVASA GOPAL, K. K. BALACHANDRAN,
P. K. SURENDRAN & T. K. GOVINDAN

Central Institute of Fisheries Technology, Cochin-682 029

Mussel pickles in oil were packed in different flexible packaging pouches like polypropylene film, metallised polyester film laminated with low density polythene and 300 cellophane polythene laminated coated with Saran and heat sealed. Storage behaviour of the packed pickles was studied at room temperature for a period of 6 months in comparison with glass bottle. Plain polyester film laminated with 150 gauge low density polythene has been found to be suitable for packaging mussel pickle in oil. The product does not take up any off order or flavour and has a shelf life of more than 6 months at ambient temperatures. Plain polyester/polythene score over glass packaging in respect of weight, volume, sales appeal and cheapness. The weight of the packaging material to pack 100 g mussel pickle in oil is only 1.5 to 1.65 g in case of polyester polyethylene laminate compared to glass bottles which weigh 170–200 g and the cost of plain polyester polythene laminate to pack 100 g of pickle is only 16 paise compared to glass bottle which costs 90 paise. Flexible pouches made of polyester polythene laminate is easier to handle than glass bottle which is fragile. The samples examined after processing and during storage showed no presence of *E. coli*, faecal streptococci and coagulase positive staphylococci.

143. A STUDY ON PHYSICAL PROPERTIES OF STRAPPING MATERIALS USED IN FROZEN SHRIMP INDUSTRY AND THE EFFECT OF FROZEN STORAGE ON THEM

T. K. SRINIVASA GOPAL & T. K. GOVINDAN

Central Institute of Fisheries Technology, Cochin-682 029

Strapping materials collected from different prawn freezing factories operating at six different centres in India were evaluated for their physical properties like tensile strength and elongation in both dry and wet conditions. It has been found that in the India frozen shrimp industry

the corrugated fibre board (Master cartons) are reinforced with 12 mm wide reprocessed high density polythene/polypropylene/rayon straps. There is considerable variation in the tensile strength of the strapping material. Majority of the strapping materials (73%) were found to have tensile strength between 930 kg/cm² and 1515 kg/cm². The effect of frozen storage on the properties of these materials revealed that the fluctuations in the tensile strength and elongation at break are less in polypropylene compared to reprocessed high density polythene and hence there are chances that the latter may give way or will not have good grip on the master carton during frozen storage, handling and transportation. In case of rayon strap the tensile strength decreases drastically with the frozen storage period and elongation at break increases.

Session VIII FISHERY PRODUCTS AND BY-PRODUCTS

Date : 26-11-1982
Time : 14.00-17.00
Venue : CIFT Hall No. 1

Chairman : **Prof. H.P.C. Shetty**
Director of Instruction,
College of Fisheries,
Mangalore-575 002

Keynote address : **Dr. Jan Raa**
Professor of Fishery Chemistry,
University of Tromso,
Box No. 790,
Norway

144. PROCESSING OF FISH BY CONTROLLED PROTEOLYSIS

JAN RAA

Institute of Fishery, University of Tromso N-9000 Troms, Norway

The paper deals with the biochemistry of tissue solubilization processes in fish and removal of skin from muscle and separation of body oil by a biochemical dissection technique. The use of controlled proteolysis in utilizing fish processing waste, small low value fish and giant squid is discussed.

145. STUDIES ON HYDROLYSATES FROM JEWFISH (*JOHNUS SP.*) WASTE

A. LEKSHMY NAIR, P. T. MATHEW & P. V. PRABHU

Central Institute of Fisheries Technology, Cochin-682 029

Fish waste obtained during preparation of fillets from jewfish (*Johnius sp.*) was subjected to hydrolysis with (a) papain and (b) pineapple enzyme. The solubilised portions were concentrated and vacuum dried and the insoluble fractions were separated and made into bone meal and unhydrolysed residue. Method of preparation of an energy food by incorporation of the hydrolysate with jaggery, spices and vegetable fat and concentration to a syrupy consistency is described. Bitter taste of the hydrolysate was masked in the finished product. The product is bacteriologically safe and had a shelf life 6-8 months at ambient temperature when preservative was added.

146. THE USE OF FISH ENSILAGE IN SUPPLEMENTARY FEEDS FOR FISH CULTURE

R. SRINIVASAN, FREDA CHANDRASEKARAN & S. AROKIASAMY

Department of Fisheries, Tamilnadu

An attempt was made to use cheap but protein rich fish ensilage as one of the composite of fish feed for major carp fries and fishes in order

to get faster growth (better yield). The experiments were conducted with fries of *Cyprinus carpio* var *communis*, *Cirrhinus mrigala* and *Catla catla*. *Cyprinus carpio* and *Cirrhinus mrigala* fries fed with feeds containing fish ensilage gained almost double the weight compared to the control. Field experiments conducted with fish ensilage feed in a pond with various combinations of fingerlings such as *Catla catla*, *Labeo*, *rohita*, *Cirrhinus mrigala* and *Cyprinus carpio* yielded additional fish production of 1400 kg/ha/year i.e. about 40% higher than that of the control.

147. SARDINE SILAGE—PREPARATION AND ITS USE IN THE FORMULATION OF MINIMAL COST DIET FOR CHICKEN

E. LESSI, M. F. ANDRADE & J. M. V. FRANQUEIRA

*Universidade Federal Fluminense Rua Dr. Mario Viana, 523-Santa Rose
Niteroi-RJ-Brazil*

Sardine silage was made with the waste from canned sardine industries with the objective of finding an alternative protein source in the preparation of chicken diet as substitute for fish meal. The sample used includes whole sardines inappropriate for industrialization, heads, viscera and tails. The silage was prepared using 3.5 ml of formic acid (85 per cent) per 100 g of homogenized sample. Chemical composition, critical mineral for chicken and amino acid composition were determined on samples of homogenized fish, the final product and silages concentrated in various forms. With respect to the concentrated silage during 48 hours, at environmental temperature, the energy value was evaluated to determine the "corrected metabolizable energy", and minimal cost

diet for chicken was formulated by means of a Linear Programming argument. Finally, it is shown that the diet costs using sardine silage, for hens and chickens, with and/or without a 5% limit, was cheaper than the conventional diet and/or the fish meal diet.

148. CERTAIN STUDIES ON FISH ENSILAGE

S. DURAIRAJ & R. SRINIVASAN

Department of Fisheries, Tamil Nadu

Results of Studies carried out on the preparation of fish ensilage by bactofermentation and without addition of water are described in this communication. A silage with good odour and desirable pH (4.0) with higher solid matter (30%) was obtained when prepared without the addition of water. The fermentation was carried out by the inoculation of *Lactobacillus plantarum* culture. The desirable pH of the silage (4-4.5) was attained within 48 h. The silage was found stable at ambient temperature for more than 3 months.

Preparing solid feed mix by mixing the liquid fish ensilage with the rice bran powder or wheat bran powder was found to be an easy way of handling the liquid product and utilising it for animal feeding. The chemical composition of the solid feed mixes prepared by mixing different proportions of ensilage with ricebran was determined.

149. DEVELOPMENT OF PICKLED PRODUCTS FROM LOW COST FRESHWATER FISHES

A. K. CHATTOPADHYAY, S. K. BHATTACHARYA & J. K. BANDYOPADHYAY

*Burla Research Centre of Central Institute of Fisheries Technology,
Burla-768 017*

Pickled products were prepared from low cost freshwater fishes namely, *Glossogobius giuris*, *Eutropiichthys vacha* and *Xenentodon cancila*. Good products could be obtained by dipping fried fish in 7% acetic acid with 5% sodium chloride for 2 hours prior to cooking. The changes in biochemical, bacteriological and organoleptic characteristics of the pickles during storage are discussed.

150. UTILIZATION OF PRAWN WASTE AND MANTIS SHRIMP FOR COMPOUNDING FEEDS FOR THE CULTURE OF PENAEID PRAWNS

SYED AHAMAD ALI & K. H. MOHAMED

Central Marine Fisheries Research Institute, Cochin-682 018

Waste materials like prawn waste (Protein 38%, energy 3.69 kcal/g) and Mantis shrimp (protein 45%, energy 3.72 kcal/g) were identified for providing animal protein in compounded feeds for culture of penaeid prawns. Four different feeds were formulated and pelletized using prawn waste, mantis shrimp, ground nut cake and tapioca to evaluate their acceptability as feeds. These feeds were tried on the Indian white prawn *Penaeus indicus* and its growth and food conversion efficiencies were found out. The efficiency of these feeds were compared with the results obtained by the use of conventional feed of fresh clam meat. Short term feeding experiments conducted on juvenile *P. indicus* at the Narakkal Prawn Culture Laboratory showed that the feed No. NPCL-21 having a composition of prawn waste 25%, mantis shrimp 35%, groundnut cake 20% and tapioca 20% gave the highest growth rate (length increase 75.4%, weight increase 400%). Among the feeds tested the highest food conversion efficiency of 3.22 was also obtained by the use of this feed. It is also interesting to note that the feed was readily accepted by the prawn and that their growth was far superior in comparison with the growth parameters obtained in the control.

The nutritional values and characteristics of these two low cost animal protein sources as feed ingredients have been discussed and detailed methods of preparation described.

151. A COMPARATIVE STUDY ON CHITOSAN WITH REFERENCE TO YIELD AND VISCOSITY

T. K. THANKAPPAN & P. MADHAVAN

Central Institute of Fisheries Technology, Cochin-682 029

Chitosan was prepared from different species of prawn shell waste and from different portions of the shell waste. In each case the shell

was taken separately as portions such as head, body and mince of these two portions. Proximate composition and yield of chitin and chitosan obtained from different sources was determined. Determination of viscosity of the different types of chitosan prepared showed that the chitosan from shell of the body portion gave higher viscosity and better yield compared to the other portions. Among the different species tried, Naran (*Penaeus indicus*) body shell was found to be the best source for chitosan of higher viscosity.

Xenox of chitosan

152. PILOT PLANT FOR THE PRODUCTION OF SHRIMP EXTRACT

S. M. S. ABUTHAHR ALI AND T. K. THANKAPPAN

Central Institute of Fisheries Technology, Cochin-682 029

The details of individual pieces of equipment and machinery of a pilot plant for the production of shrimp extract based on an improved process of coagulation and settling of the water insoluble fractions of protein obtained from wet prawn shell waste, with chitosan, which results in considerable savings in the cost of production are described in this paper. The economics of operation of the pilot plant to produce 50 kg/day of shrimp extract is also discussed.

153. NUTRITIONAL QUALITY OF SHRIMP EXTRACT POWDER

R. THANKAMMA, A. LEKSHMY NAIR & P. MADHAVAN

Central Institute of Fisheries Technology, Cochin-682 029

Shrimp extract powder was prepared by mild alkali digestion of shrimp waste, neutralisation, concentration and vacuum drying of the alkaline extract in yields varying from 8-12% of the weight of wet shrimp waste. The shrimp extract powder obtained had 3.58% moisture, 67.5% protein, 11.8% fat and 12.38% ash. The nutritional quality of the product was assessed by feeding trials on albino rats using diets containing 10% protein. The protein efficiency ratio of the shrimp extract powder (2.03) was lower than that of the reference protein, casein (2.83). A mixture of shrimp extract powder and casein (1:1) had a protein efficiency ratio comparable to that of casein (2.67). No untoward

symptoms were observed during the feeding trials. Determination of fresh organ weights and their nitrogen content showed no negative effects of the shrimp extract powder.

Original paper is obblanned

154. NUTRITIONAL EVALUATION OF PRODUCTS FROM SQUILLA

A. LEKSHMY NAIR, P. T. MATHEW & P. V. PRABHU

Central Institute of Fisheries Technology, Cochin-682 029

Precipitated protein, water soluble nitrogen fraction and whole squilla extrudate after separation from chitinous matter have been isolated from squilla by a simple physical process and their proximate composition determined. Nutritive quality of the various extracted products has been evaluated by feeding trials on albino rats. PER of precipitated squilla protein and casein were similar and comparable. The weights of liver and kidney of rats fed both diets were normal and no untoward symptoms were noticed. Water soluble nitrogen fraction from squilla, on feeding to rats, produced a peculiar effect of the coat turning rough, sticky and brownish within 24-28 hours of diet intake. Alopecia was also noticed. Food intake was poor and PER was low. Rats, when fed on whole protein powder from squilla did not show untoward symptoms upto about two weeks feeding, although food intake was low compared to casein diet. After 15-20 days' feeding, rats started showing alopecia and adverse effect on the skin. PER was lower than that for reference protein namely, casein.

155. FORMULATION OF ARTIFICIAL DIETS FOR COMMON CARP (*CYPRINUS CARPIO*)

P. T. MATHEW, K. G. RAMACHANDRAN NAIR & P. MADHAVAN

Central Institute of Fisheries Technology, Cochin-682 029

Artificial diets have been formulated and feeding trials conducted on fingerlings of common carp (*Cyprinus carpio*) for a period of three months. Fish meal, prawn shell powder, partially demineralised prawn shell powder, groundnut cake and tapioca starch were the raw materials used for the formulation of the feeds. Adequate amount of vitamins

was also added. Three samples of feed were formulated with different proportions of the ingredients. Of the three samples maximum weight gain was recorded in the case of feed which contained 50% tapioca starch, 24% groundnut cake, 24% prawn shell powder and 1% groundnut oil. The crude protein of the feeds ranged from 14 to 20%. Conversion ratio was higher in the case of this sample and mortality rate minimum.

**156. FISH MEAL PRODUCTION FROM TILAPIA FISH
(*TILAPIA MOSSAMBICA*) GROWN ON
POULTRY DROPPINGS**

M. NATARAJAN, N. N. PATHAK & C. GANNADHAM

Indian Veterinary Research Institute, Izatnagar-243 122

Preliminary investigations were undertaken to study the possibility of converting tilapia (*Tilapia mossambica* Peters), grown in an earthern pond fertilised with only poultry droppings, into fish meal and its utilization as feed for pigs. Tilapia was grown under monoculture in an earthern pond (area 950 sq. m.). The pond was fertilised with only poultry droppings and no supplementary feed was given. A production of 1856 kg/ha was obtained. The harvested tilapia was directly sundried to less than 10% moisture level and pulverized to make fish meal. The yield of fish meal was 20.8%. The proximate composition of this meal was: moisture 9.07%, crude protein 47.34%, fat 1.48%, ash (total) 47.74% and acid insoluble ash 8.78%. Incorporation of tilapia fish meal at the rate of 5% for a period of 46 days in the rations of Landdrace finisher pigs (5 nos.) recorded an overall increase in the growth rate of 14.28%, when compared with the control group.

**157. EFFECT OF SODIUM CHLORIDE TREATMENT ON THE
QUALITY OF SARDINE OIL IN PRESS LIQUOR
AT ROOM TEMPERATURE**

B. A. SHAMASUNDER & C. S. BHANDARY

College of Fisheries, Mangalore

Sardine oil in press liquor deteriorates rapidly during temporary storage awaiting centrifuging, or when left as such for separation of oil

and water. The efficacy of sodium chloride treatment to prevent quality deterioration of sardine oil in press liquor was investigated. Three different concentrations of sodium chloride, namely, 5; 10 and 15 per cent were used. It was found that 10 and 15 per cent Nacl treatments were effective in retaining the quality of oil in press liquor for 10 days. The quality of oil was assessed by odour, colour, acid value and test of rancidity. Increase in total volatile bases and total microbial load of press liquor were inversely proportional to the concentration of sodium chloride used to treat the press liquor. The degree of unsaturation and saponification was unaffected by the treatment. After centrifugation, the oil was found to be free from traces of sodium chloride.

158. COMMERCIAL PRODUCTION OF SHARK LIVER OIL IN GUJARAT

A. D. DHOLAKIA

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&

G. D. VASAVDA

*Assistant Director of Fisheries (Training) K. S. Bhullar Road,
Veraval-362 265*

The paper reports data on landings of shark and production of shark liver oil for the last sixteen years in Gujarat. On an average about 6860 tonnes of sharks are being landed in Gujarat annually. Details of the first modern shark liver oil factory set up by the Government of Gujarat alongwith the process are presented. Technical data on the yield of shark liver oil, its quality, present market position and economy of the commercial shark liver oil production are also discussed.

159. RECOVERY AND YIELDS OF MINCES FROM SILVER BELLY (*LEIOGNATHUS* spp), MACKEREL (*SCOMBER SCOMBRUS*) AND THE SARDINE-LIKE SPECIES (*CENTEGRAULIS*) (*MYSTICETUS*) USING A BAADER 694 MEAT/BONE SEPARATOR

C. D. WOOD & D. KING

Tropical Products Institute, 56/62 Gray's Inn Road, London, WCIX/8LU, United Kingdom

Minced fish made by meat/bone separators has been used in the preparation of a wide variety of products. The original development work was directed at recovering and using the flesh from fillet frames of large fish.

Under-utilized species which would normally be precluded from acceptance due to appearance, flavour, texture, or small size may be used for mince preparations. The presence of small, sharp bones and scales in many under-utilized species could cause problems unless excluded from the mince.

The composition and yields of mince from three species, silver belly (*Leiognathus* spp), mackerel (*Scomber scombrus*) and the sardine like species (*Centergraulis mysticetus*) were investigated using a Baader 694 meat/bone separator, fitted with drums with orifices of various sizes.

It was found that the yields of mince were little affected by the orifice size of the drum, but bone and scale content was lower when the orifice size was smaller. Taste panel evaluation indicated that the smaller orifice size had no detrimental effect on the texture of fish cakes. Bones of sufficient size to be detected by the consumer were not found in any of the minces prepared.

It was concluded that a 5.0 mm drum orifice was suitable for general use, including small intact bony fish. Smaller drum orifices could be used with little risk of adversely affecting the quality of the minced product.

160. STABILIZED PRODUCTS FROM THERMAL PROCESSED FISH

R. BALAKRISHNAN NAIR & A. V. GIRIJA MENON

Central Food Technological Research Institute, Mysore

Two low cost convenience foods (stable at room temperature) have been prepared from small bony varieties of fish. In both, thermal processing has been employed to soften the bones and improve flavour. In one product, a dehydrated cutlet mix, low fat species of fish have been processed with starchy ingredients and flavour components. Microbial safety and product quality in terms of flavour, texture and reconstitution properties have been achieved through proper choice and blending of ingredients and process manipulation. In the second product, a dehydrated spiced mix, fatty species of fish have been used. Stability against rancidity development has been achieved through the use of natural ingredient, *Garcinia cambogia* (Malabar tamarind). Apart from possessing antioxidant properties, the latter was found to depress peroxides, already formed in the lipids. Stability against rancidity was assured at levels less than what was necessary as an acid ingredient. Both products have been subjected to storage studies with respect to microbial status and product quality, and were found to be stable for over one year.

161. STUDIES ON SOME ASPECTS OF PROFITABLE UTILISATION OF TRASH FISH FOR HUMAN HEALTH AND NUTRITION

N. D. CHHAYA, R. G. DABHI, Y. A. TRIVEDI,
D. M. NIMAVAT & C. N. KAATRI

Gujarat Fisheries Aquatic Sciences Research Institute, Port Okha

This paper discusses the preparation, nutritive contents as well as the beneficial effects of the edible protein concentrate tablets from trash fish. It was reported by consumers of various levels that use of these tablets increased appetite and weight, skin became healthier and improved general health conditions. The commercial feasibility of the project is also discussed. The cost of 1000 protein tablets of 250 mg each was arrived around Rs. 20/-.

162. PRESENT STATUS AND ITS FUTURE PROSPECTS IN DIVERSIFICATION OF MARINE PRODUCTS AND MARKETS FROM INDIA

G. SANTHANA KRISHNAN

Marine Products Export Development Authority, Cochin-682 016

Status of marine products industry with special reference to diversification of products and markets are briefed with examples of successful events of case histories such as export of raw head-on shrimp and frozen clam meat. Also briefed are the products developed until the stage of marketing after assessing product acceptability, like dried squids, frozen sharks and froglegs packed in Indonesian style. Further prospects on export of dried acetus, boiled and dried anchovies to southeast Asian countries, frozen eels to Japan and Europe, were also highlighted thus giving a comprehensive picture on products/markets diversification in marine industry of India.

Session IX FISH INSPECTION AND QUALITY CONTROL

Date : 27-11-1982
Time : 09.00-11.00
Venue : CIIT Hall No. 1

Chairman : **Shri R. Madhavan Nair**
Cochin Company (P) Ltd.,
Cochin-682 016

Keynote address : **Shri O. P. Dhamija**
Additional Director,
Export Inspection Council of
India,
Cochin-682 011

163 PROBLEMS OF SALMONELLA IN MARINE FOOD PRODUCTS — A REVIEW

R. NATARAJAN, T. RAMAMURTHY & S. RAMESH

*Centre of Advanced Studies in Marine Biology,
Annamalai University, Porto Novo-608 502*

The human enteropathogen, *Salmonella*, has been associated in numerous food-borne gasteroenteritis outbreaks. It has been isolated from many marine food products such as fresh, sundried, frozen and canned products. Since its discovery, this bacterium has been the subject of considerable interest from both ecological and public health points of view. Much work is needed in the detection of these bacterium from non-human sources. The paper discusses its distribution, pathogenicity, serology, epidemiology and control (hygienic production).

164. TECHNOLOGICAL INVESTIGATIONS ON NON-PENAEID PRAWN FISHERY—QUALITY SURVEY OF DRY NON-PENAEID PRAWN OF BOMBAY MARKETS

A. P. VALSAN, V. N. NAMBIAR, S. P. DAMIE, D. K. GARG,
T. S. GOPALAKRISHNA IYER & N. M. VASU

*Bombay Research Centre of Central Institute of Fisheries
Technology, Bombay-400 005*

Dried non-penaeid prawns were collected from three main fish markets of Bombay city namely, Crawford, Dadar and Swere. Representative samples were critically analysed for organoleptic, biochemical and bacteriological parameters. Marked quality variations were observed. Most of the samples were unsatisfactory because of off

smell, discolouration, excessive extraneous matter, broken pieces and insects. The moisture and acid insoluble ash were undesirably high. A few samples recorded high total volatile nitrogen values indicating excessive spoilage. Total bacterial count in a few cases was usually high. In a few isolated cases faecal *streptococci* were detected. *Salmonella* was isolated from one of the samples examined. The strains isolated were confirmed to be *S. enteritidis*. The study clearly indicates that the market samples are generally unsatisfactory and stresses the imperative need for overall improvement by using only fresh raw material, better drying conditions, strict quality control measures and improved packaging.

165 BACTERIOLOGICAL QUALITY OF FROZEN SEAFOODS FOR EXPORT WITH SPECIAL REFERENCE TO SALMONELLA

P. R. G. VARMA, CYRIAC MATHEN & ANNAMMA MATHEW

Central Institute of Fisheries Technology, Cochin-682 029

The paper presents an account of the bacteriological quality of frozen seafoods for export collected from the fish processing plants in and around Cochin during 1980 and 1981. The bacteriological quality of two major export items, frozen shrimp, both raw and cooked and frozen cuttle fish are discussed. The paper gives the percentages of samples unacceptable as per the recommended standard with regard to total bacterial count, *Escherichia coli*, coagulase positive *Staphylococci* and *Salmonella* in frozen shrimp and also *Vibrio cholerae* in frozen cuttle fish. The overall bacteriological quality of frozen shrimp and cuttle fish were very good and the incidence of *Salmonella* was below 2%. All the samples of cuttle fish were free from *Vibrio cholerae*.

166 FILTH IN FROZEN SHRIMP

FRANCIS THOMAS & P. R. G. VARMA

Central Institute of Fisheries Technology, Cochin-682 029

The paper presents the extent of contamination of frozen shrimp for export with filth, collected during the year 1981-82. The filth

isolated from frozen shrimp of different packs like headless, peeled and deveined, peeled and undeveined and of different size grades is discussed. Compared to peeled and deveined and peeled and undeveined shrimps, headless shrimps were almost free from filth. The common filthy materials encountered are flies, fly fragments and hairs. In all these samples analysed filth was well below the U.S.F.D.A. permitted levels.

167. EVALUATION OF CERTAIN FACTORS AFFECTING THE TPC OF FROZEN SEAFOODS

NIRMALA THAMPURAN & K. MAHADEVA IYER

Central Institute of Fisheries Technology, Cochin-682 029

The total plate count (TPC) is considered to be an important index to determine the hygienic quality of the product. Different parameters that influence the recovery of micro organisms during bacterial enumeration of frozen seafoods were evaluated. The parameters studied were plating technique, incubation temperature, incubation period and the diluent. The results were statistically analysed and it was found that spread plate technique yielded higher bacterial count than pour plate technique. An incubation temperature of 30°C was found to facilitate greater bacterial recovery than the conventional 37°C. Comparing incubation periods of 24, 48, 72 and 96 h, it was found that an incubation periods of 48 h was sufficient for frozen marine products. Similarly it was noted that phosphate buffer and normal saline were equally effective in enhancing bacterial recovery, other diluents studied being sea water, peptone water, distilled water and quarter strength Ringer's solution. Hence a combination of these factors namely spread plate method with an incubation temperature of 30°C and incubation period of 48 h using either phosphate buffer or normal saline as the diluent is recommended for better bacterial recovery when determining the TPC of frozen seafoods.

168. LEVEL OF URIC ACID CONTENT AS AN INDEX OF UNHYGIENIC CONDITIONS AND ACCEPTABILITY OF INSECT INFESTED FISH PRODUCTS

K. K. SOLANKI

Veraval Research Centre of Central Institute of Fisheries Technology, Veraval-362 265

Estimation of uric acid in infested dried fish is reported by a slightly modified method using Benedict's uric acid reagent for its quick and accurate measurements. Several samples of freshly prepared and commercially available dried fish products including fish meals were examined for uric acid content alongwith their physical and biochemical qualities to correlate the hygienic condition and acceptability of the product with reference to the level of the uric acid content in these products. Results showed that the uric acid content in the dried fish product increased steadily with the progress of infestation depending on the intensity of the infestation and storage period of the products. Acceptability and hygienic condition of the infested fish products progressively decreased with the increase in the uric acid content of the infested samples. Freshly prepared dried fish products under controlled condition contain almost negligible amount of uric acid and uric acid related substances. Results of the studies emphasised that the level of uric acid can also serve as a very good index to determine the unhygienic condition and acceptability of the majority of dried fish products.

169. USE OF CATALASE VALUES AS AN INDEX OF QUALITY OF OIL SARDINE (*SARDINELLA LONGICEPS*) IN ICE STORAGE

K. V. LALITHA & K. MAHADEVA IYER

Central Institute of Fisheries Technology, Cochin-682 029

The amount of catalase in the tissues of oil sardines during ice storage was estimated in a series of experiments. The organoleptic quality of the muscle, as well as total plate count, the amounts of bacterial catalase, trimethyl amine and total volatile nitrogen were determined

side by side. Changes in the bacterial catalase values were not in agreement with the changes in bacterial count. But, it has been observed that the muscle catalase values are in good correlation with organoleptic evaluation of quality of oil sardines and hence, it can be used as an index of quality of sardines during ice storage.

170. USE OF FRESHNESS METERS FOR QUALITY ASSESSMENT OF TROPICAL FISHES

P. R. G. VARMA, CYRIAC MATHEN & FRANCIS THOMAS

Central Institute of Fisheries Technology, Cochin-682 029

The paper presents the results of the studies on the comparative efficiency of Torry meter and Intelectron fish tester for assessing the quality of five varieties of fish namely, tilapia, pearl spot, mullet, mackerel and oil sardines stored at ambient temperature and in ice. During storage of the fish at ambient temperature and in ice the Torry meter readings did not show any significant changes, whereas the Intelectron fish tester readings showed significant changes and thus can be used for quality assessment. The Intelectron fish tester readings showed sharp changes during storage in ice, but it changed comparatively slowly during room temperature storage, probably due to the partial drying of skin.

171. USE OF THE GR TORRY METER WITH TROPICAL SPECIES OF FISH

R. G. POULTER & C. A. CURRAN

*Tropical Products Institute, 56/62 Gray's Inn Road, London,
WCIX 8Lu, United Kingdom*

The need for a rapid, objective method for measuring fish freshness lead to the development of the GR Torrymeter. This portable, electronic instrument measures the changes in the dielectric properties of fish muscle as spoilage proceeds. The meter has been tested extensively in Britain with cold water species and has been found to give a quick, reliable indication of the quality of fresh fish. In recent years, several

studies have been conducted with tropical fish. This paper reviews the results obtained and shows that the meter has been successful with many species. A comparison with the data from cold water species shows that in both cases the readings contained vary from species to species and that, in general, the meter is less reliable with high fat content fish.

Session X EXTENSION AND EDUCATION IN FISHERIES

Date : 27-11-1982
Time : 11.15-13.00
Venue : CIFT Hall No. 1

Chairman : **Dr. P. V. Dehadrai**
Commissioner of Fisheries,
Ministry of Agriculture,
Krishi Bhavan,
New Delhi-110011

Keynote address : **Dr. C. T. Samuel**
Professor and Head,
Department of Industrial
Fisheries,
University of Cochin,
Cochin-682 016.

PLENARY SESSION

Date : 27-11-1982
Time : 14.00-15.30
Venue : CIFT Hall No. 1

Chairman : **Dr. C. C. Panduranga Rao**
President,
Society of Fisheries Techno-
logists (India) &
Director,
Central Institute of Fisheries
Technology,
Cochin-682 029

172. COMMUNICATION MEDIA IN RELATION TO ADOPTION OF SCIENTIFIC FISH CULTURE

P. DAS, U. BHAUMIK, P. K. PANDIT, B. K. BANERJEE & B. ROY

Central Inland Fisheries Research Institute, Barrackpore, West Bengal

Statistical sample survey of fish farmers from 11 villages regarding the extent of utilization and adoption of aquaculture practices on scientific lines are discussed. The level of adoption of composite fish culture varied between 50 and 95 per cent. The role played by different sources of information such as mass media, personal cosmopolite source, personal localite source and training are assessed. The relation between adoption and rejection with age, qualification, occupation and experience were also assessed.

173. FISHERMEN'S SHARE IN CONSUMER'S ONE RUPEE—A CASE STUDY

K. K. P. PANIKKAR & R. SATHIADHAS

Central Marine Fisheries Research Institute, Cochin-682 018

Fishermen's share in the consumer price of commercially important fishes were analysed taking Sakthikulangara, one of the biggest landing centre and Kottarakara, Punalur, Kozhencerry and Chengannoor (Kerala) as primary consumer markets. The marketing practice, transportation, marketing margin and its components for five varieties of fish are studied. This indicated that fishermen's share is between 31 to 68%, transportation and handling ranged between 6 and 7% and that of wholesalers and retailers ranged from 15-37% and 11-25% respectively.

174. PRESENT STATUS OF FISHERIES EDUCATION (EXTENSION) FOR FISHERY OFFICERS IN INDIA

H. G. HINGORANI

Central Fisheries Extension Training Centre, Hyderabad-500 659

Fisheries education in India at various levels are conducted by different governmental agencies such as CIFE and its sub centres, IFTC, Barrackpore, Agricultural Universities, Krishi Vigyana Kendras, State Fisheries Departments, CFETC, Hyderabad etc. There are a number of constraints in organising and conducting these training centres. To rectify the defects in the present system it is necessary to have a close co-ordination between fisheries research institutes, educational institutions, universities, ICAR and department of fisheries of both government of India and state. Various measures to revamp and regulate the entire system are discussed.

175 EXTENSION METHODOLOGY FOR FISHERMEN AT DIFFERENT LEVELS

H. G. HINGORANI

Central Fisheries Extension Training Centre, Hyderabad-500 659

Even though fisheries in India is on a sound footing and there has been all round progress in development research and education, the conditions of the fishermen is far from satisfactory. Even now the fishermen are poor, illiterate, orthodox, superstitious and socially backward. They need more income from their profession, social uplift proper housing, sanitation and education. The governmental schemes such as A.R.D.C., I.D.R.C. etc. remain mostly unimplemented due to time consuming formalities, redtapism and lack of communication. Proper extension methodology is the only way to overcome this. Various methods of approaches are discussed.

176. PERSONAL AND SOCIO-ECONOMIC CORRELATES OF ADOPTION OF IMPROVED FISH CURING PRACTICES

P. N. KAUL & S. BALASUBRAMANIAM

Central Institute of Fisheries Technology, Cochin-682 029

Personal and socio-economic aspects for the adoption of improved fish curing practices based on socio-economic factors of different fish curers in Kerala were analysed for adoption index on eight improved methods. The intercorrelation among various variables are discussed together with the implication for further work.

177. AN ECONOMIC ANALYSIS OF PURSE SEINING FROM 13.25m PURSE SEINER AND FROM ARTISANAL FISHING CRAFT 'THANGUVALLAM' ALONG THE KERALA COAST

P. A. PANICKER

Central Institute of Fisheries Technology, Cochin-682 029

In the present context of introducing purse seining on commercial scale, an economic assessment of it is all the more important taking into consideration of the present level of exploitation and scope for further exploitation. Pelagic fishery being the most important one along the south west coast of India and purse seining an expensive and a high efficiency method that can be even detrimental to the standing stock and the artisanal fishing as well, has to be introduced on a limited scale only. The various economic aspects of purse seining, its feasibility, constraints, effects on artisanal fishing and the standing stock are discussed in detail. An alternate method of purse seining by the artisanal fishermen from their traditional craft, its economy and its role in the exploitation of the pelagic fishery resources of Kerala region are also included and suggested that both artisanal and mechanised purse seining can go hand in hand if proper checks are made.

178. ECONOMICS OF OPERATION OF FISHING VESSELS (TRAWLERS)

H. KRISHNA IYER, P. SRINIVASA RAO, G. R. UNNITHAN,
A. K. KESAVAN NAIR AND R. G. NAIR

Central Institute of Fisheries Technology, Cochin-682 029

The results of case studies conducted in connection with economics of operation of fishing vessels (trawlers) are reported. Among 32 and 36 feet fishing boats of over all length, which are in operation in large numbers along Kerala coast, the return over investment was estimated and found to be better for 32'boat. Also the study has indicated that the number of days of operation in a year was a determining factor responsible for the profit or loss of the fishing boat.

179. IDLE CAPACITY OF FISH PROCESSING (FREEZING) PLANTS IN INDIA—A COMPARATIVE STUDY OF PLANTS IN EAST AND WEST COASTS

H. KRISHNA IYER, P. SRINIVASA RAO, G. R. UNNITHAN,
A. K. KESAVAN NAIR & R. G. NAIR

Central Institute of Fisheries Technology, Cochin-682 029

The idle capacity of the fish processing (freezing) plants in India was estimated using a stratified random sampling plan. The estimates of idle capacity of the plants in east and west coasts showed that there were substantial under-utilisation of plants in both the coasts. The major factors responsible for the idle capacity of the plants in these coasts were non-availability of raw material and high cost of production. The error of estimates of idle capacity in these two coasts were well within reasonable limits.

180. INDIAN MARINE FISHERIES IN THE COMING DECADES: A VIEW POINT

S. DUTT

*Department of Marine Living Resources, Andhra University,
Visakhapatnam-530 003*

India has a rich marine stock of multispecies prawns and fishes as in the case of other tropical environments. A distinctive feature of these stocks is that no single species accounts for even a major fraction of the catches unlike the temperate waters. Although, India has declared its exclusive economic zone, it should be apparent that during the next decade or two, exploitation of natural stock will be largely confined to the inner half of the continental shelf as at present due to various socio economic reasons discussed in the paper.

181. PROSPECTS OF DEEP SEA FISHING

T. A. MAMMEN

Tropical Fisheries Consultancy Services, New Delhi-110 032

Deep sea fishing has all along been a priority item on the five year plans. Even now as much as 80% of the plan outlay in the central sector is devoted towards direct and indirect assistance to development of deep sea fishing. Yet deep sea fishing, as such, is yet to develop in India. Research publications are highly optimistic of the potential resources; governmental quarters feel that they have offered the most generous concessions, foreign and Indian counterparts are keen to enter into deep sea fishing, but deep sea fishing, except for the relatively near shore shrimp trawling is yet to develop. In this context it is necessary to consider what has gone wrong with our system; are there no resources; is entrepreneurship lacking; or is the bureaucracy too strong in India? These aspects are discussed.

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